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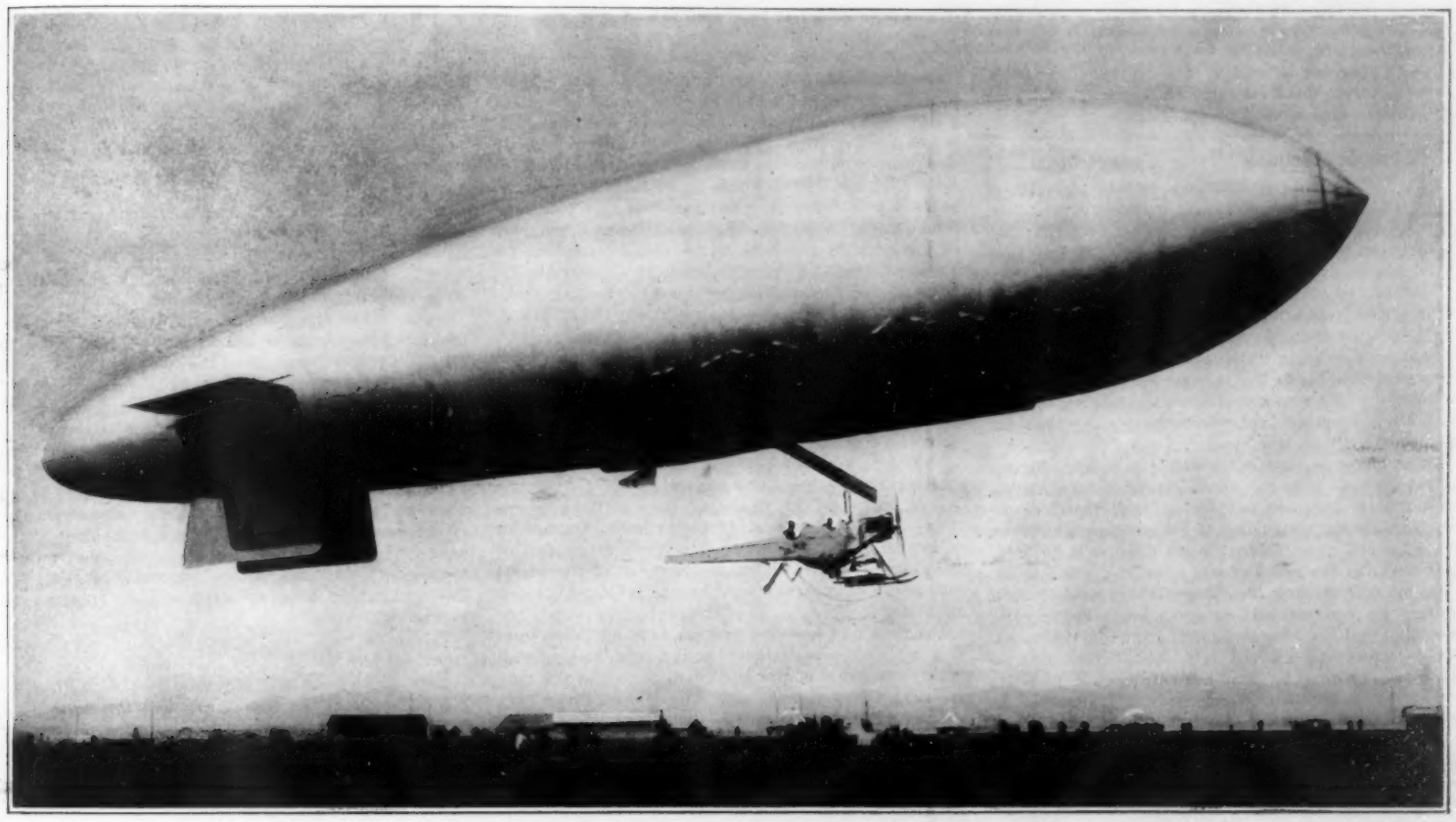


One of the new British scouting dirigibles starting on a reconnaissance flight over the enemy lines on the Balkan front

A Novel British Airship

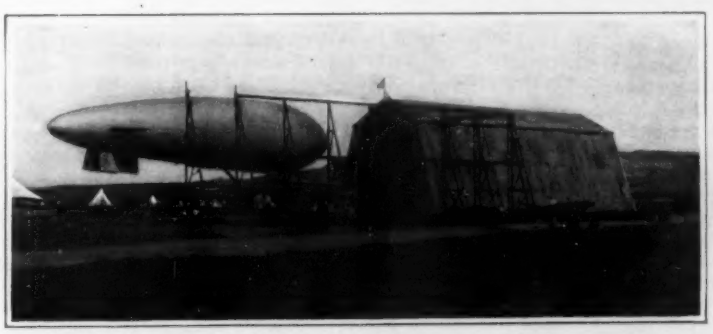
By Baron Ladislas d'Orcy

THE dirigible represented herewith is one of Great Britain's small scouting airships, which have been provided for in the new British aerial construction program for 1915-17. This program is said to comprise the laying down of 50 airships of both the rigid and non-rigid types, the construction to be completed within two years.

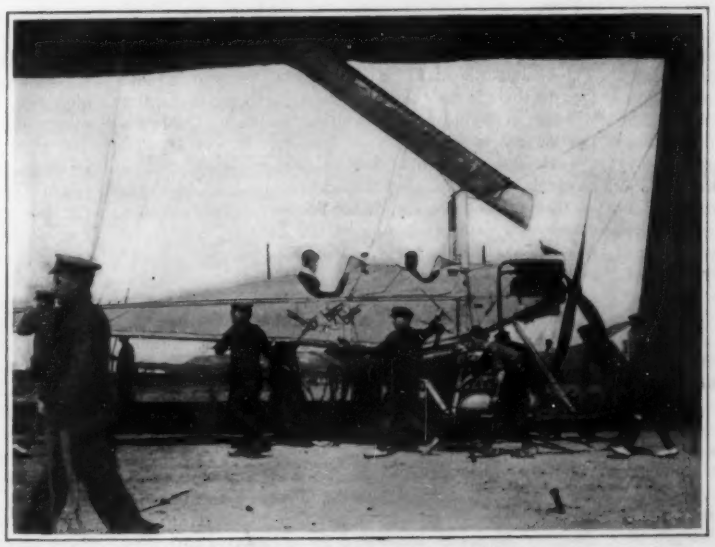
The airships of the type shown in the accompanying illustrations are comparatively small craft and their range is naturally a limited one; they are, however, capable of a great speed which makes them particularly desirable for scouting.

A unique feature of this dirigible is its car, which is constituted by an ordinary fuselage of a British army aeroplane, complete with its engine, tractor air-screw and landing gear, except for the wheels. This disposition is very commendable, particularly for small airships, as it advantageously does away with the heavy car, which, with its elaborate engine mounting and propeller transmission, greatly reduces the useful load and also creates much head resistance, harmful to the vessel's speed.

In the latter respect the design of this airship seems remarkably efficient, head resistance being cut down to the possible minimum, there being, in fact, but two stream-lined bodies (envelope and fuselage), connected by a simple suspension. The excellency of this design also accounts for the relatively small power plant, which is constituted by a 70 horsepower, water-cooled Renault engine, driving a tractor screw. The speed airships of this class develop is not officially disclosed, but seems to be in the neighborhood of 40 miles per hour, rather more than less.



Light British scouting dirigible leaving its hangar at a Mediterranean base



Car of a new British dirigible, which is a slightly modified aeroplane fuselage

An interesting feature that is entirely novel and shows a persistent thought of simplifying the mechanical devices of this airship, is found in the air-blower, which compensates on non-rigid airships such losses of buoyancy that may occur through variations of temperature and barometric pressure. Instead of using an ordinary air-blower actuated by the engine, the designers of this airship utilize the "slip-stream" of the propeller; *i. e.*, the air thrown back by the latter. For this purpose the envelope's "neck," through which air may be pumped into the compensating ballonet, has its aperture placed right behind the propeller, the amount of air admitted into the ballonet being regulated by a valve. Besides its great simplicity, this arrangement strongly commends itself on account of the amount and driving power of the air that thus becomes available for compensating losses of buoyancy in the gas bag of the airship.

Although their work has been less spectacular than the operations of German Zeppelins, the non-rigid and semi-rigid airships of Great Britain and France have proven very useful for night raids on enemy encampments, and, in connection with naval warfare, for harbor defense and coast patrol work. According to the *Echo de Paris*, the mobile forces of every French naval port now comprise, in addition to destroyers and submarines, two small non-rigid airships. These are chiefly used for detecting enemy submarines, and are said to have given an excellent account of themselves.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

What is Adequate Naval Preparedness?

A CORRESPONDENT asks us to state what is meant by adequate naval preparedness, and we propose to answer that question by pointing to actual conditions as they once existed and as they now exist in the navy of the United States. To begin with, let us ask first: Was there ever a time when the United States navy was adequately prepared? and secondly: Is the United States navy adequately prepared to-day? The answer to these two questions involves a comparison of conditions in the year 1905 and 1916, and the comparison proves to a demonstration that we were as completely prepared in the first-named year as we are inadequately unprepared to-day.

It is, of course, impossible within the limit of space at our disposal, to go into all the details of the condition of our navy in these two periods, and therefore we shall confine our comparison to the question of strength in ships and guns. What do we discover? In 1905, our navy, as the result of the lessons of the Spanish War and the patriotic liberality of Congress, had risen during the preceding six or seven years to the commanding position of second naval power in the world. That our rapidly-attained rank was beyond dispute is shown by the fact that the third power in rank, which happened to be Germany, was far behind us both in the number of her battleships and in the power of her main batteries; for in 1905 the main fighting line of the United States navy consisted of twenty-five battleships, as against Germany's twenty, and the total muzzle-energy of all guns in the United States battle-line was a little less than four million foot-tons, whereas the total energy of all the guns on the German battle-line was considerably less than two million foot-tons.

Now these figures, which are based upon the most authentic records, if they prove anything at all, prove just this: That in 1905 the United States, in holding the position of second in naval strength, possessed a superiority in its first fighting-line of twenty-five per cent in ships and over one hundred per cent in gun power, over the third ranking naval power, which in that year happened to be Germany.

That is what we call a condition of adequate preparedness, and it was adequate because our fleet, numerous, powerful, carrying unusually heavy batteries, and operating within easy reach of its bases, would have been more than a match for any fleet that Germany, France, Austria or Italy could send across the Atlantic Ocean. We make no mention here of the British fleet for the reason that in her possession of Canada, Great Britain has given hostages to fortune, and in the nature of things is almost as much committed to the defense of the Monroe Doctrine as we are ourselves. In fact, the "London Times," commenting upon a suggestion that England in return for certain European concessions might forego her active support of the Monroe Doctrine, stated that the thing was unthinkable, and ended its comment on the matter by saying "If the United States possessed no Monroe Doctrine, Great Britain would have to formulate one of her own."

Adequate naval preparedness, then, means for the United States the possession of a fleet so strong and efficient that no hostile nation could cross the Atlantic or Pacific Ocean and attack with any hope of success.

For illustration of a state of naval unpreparedness it is sufficient to quote by way of contrast the statistics covering the status of the second and third naval power for the year 1916; for to-day the conditions have been absolutely reversed. Germany has moved up from a poor third to a commanding second position, whereas we have not only dropped into the third position, but that position is shared jointly with us by France, which is about equal to us in its number of first-line battleships, and is greatly superior to us in the strength of its personnel; that is to say, in the number of its officers and men.

Comparing the two fleets then, under their reversed positions, we find that to-day Germany's first fighting-line includes twenty-six ships, the total energy at the muzzle of all guns on those ships being over thirteen million foot-tons, as compared with the United States first fighting-line of only twelve ships actually completed, whose total gun-energy is something over seven million foot-tons or a little over one half that of the German fleet. So that to-day the situation is that there is one fleet, that of France, which is about equal to our own, and there is another fleet which possesses in its first fighting-line twice as many dreadnoughts mounting over twice as many armor-piercing guns, whose total energy is nearly double that of our own fleet. That is what we have in mind when we state that the United States navy to-day is in a condition of very alarming unpreparedness.

Thus far, we have been making our comparison on a basis of material—ships and guns—and we have found that on this basis the fleet which a decade ago was a poor second to our own, possesses to-day a one-hundred-per-cent superiority. This is bad enough; but our unpreparedness becomes shockingly apparent, when we state that the United States navy, for war purposes, is short over thirty thousand men and over two thousand officers. What this means is best told in the report of the minority members of the House Committee on Naval Affairs:—"To provide, says the report, full complements for all dreadnoughts, predreadnoughts, cruisers, scouts, destroyers, submarines and the necessary auxiliaries now in the navy, or that will be during 1917, will require 82,762 men or approximately 31,000 more than the present authorized strength of the navy. This number of men, 82,762, required on a war basis, does not include 10,015 men required for merchantmen scouts and other auxiliaries needed in the service in time of war, nor an additional 10,000 men to man mine sweepers, patrol boats and smaller craft."

Now let us get the full significance of these figures firmly fixed in our minds. Our navy is now manned, or rather undermanned, by 52,000 men. In the opinion of the General Board, which is composed of the ablest officers of our navy, it should be manned by 82,762 men to render it efficient. That the great fleet, which has taken from us the second position, is at all times properly manned, goes without saying, and to-day, with nearly two years of war conditions behind it, you may be sure the personnel—the officers and men—have been trained to a high pitch of efficiency.

Remembering that the question of naval preparedness is relative, that a navy is prepared or unprepared according as it measures up to, or falls short of, its ability to uphold the country's policies, and prevent the outbreak of hostilities by offering a fighting-line so strong as to discourage aggression—remembering these things, we do not hesitate to say that the United States navy, in spite of the excellence of its ships and guns and the high quality of its personnel, is as completely unprepared in the year 1916 as it was fully prepared in the year 1905.

Our Opportunity in the Antarctic

THE only party of polar explorers from this country now in the field, the Crocker Land expedition, is expected to return home during the present summer. Meanwhile, our British cousins, notwithstanding the distractions of the war, are represented in the Antarctic by the two branches of the Shackleton expedition, and in the Arctic by the two branches of the Stefánson expedition; while a new Canadian expedition, under Captain Bernier, is in preparation. Norway is backing Amundsen's forthcoming Arctic drift. Denmark has provided the means for Rasmussen's exploration of northern Greenland. Russian explorers, since the war began, have achieved the splendid exploit of the Northeast Passage. All of which suggests that our own polar explorers should look to their laurels, and makes it pertinent to inquire whether it would not be well to revive at this time the project of an American Antarctic expedition.

Such a suggestion is particularly appropriate at a moment when the news is not yet cold of the safe arrival at the Falkland Islands of a part of the Shackleton expedition, and of the definite location of the balance of his party. This means much to any prospective American expedition. It means in the first place that the work of rescue could be pushed promptly to success or definite failure, and that thereafter the expedition would be under no urge to devote valuable time and effort to this matter. It means, too, that there would be no unconscious duplication of the labors of Shackleton; the work could be taken up at the precise point where full reports show the British lieutenant to have left off.

On the other hand, with the seafaring nations of the Old World all seriously handicapped by the war, it would seem especially opportune to revert to the plan, so earnestly advocated by Admiral Peary and others about six years ago, of an American expedition to Weddell Sea. Our country has conspicuously neglected the exploration of the Antarctic ever since the epoch-making discoveries of Wilkes, in 1840. Indeed, although American whalers and sealers were among the pioneers in the exploration of the Antarctic seas, and the first to glimpse the Antarctic continent, the only regular scientific expedition we have ever sent to the Antarctic was that of Wilkes.

There is still time to organize and equip an expedition before the season of navigation opens in southern seas, i.e., about the end of the year. Peary estimated in 1910 that such an undertaking would cost from $75,000 to $100,000 per annum. A well-trained personnel could easily be recruited in this country.

Some Aspects of "Daylight-Saving"

THE great war in Europe has been prolific in unexpected by-products. Not the least interesting of these is the action just taken by several of the belligerent and adjacent neutral nations to give official sanction to a scheme which, though it originated in England and not in Ireland, disguises its purpose of saving gas and electricity under the name of the "daylight-saving plan." This scheme has been persistently agitated for many years, not only in Europe, but also in America and Australia. Innumerable public bodies have passed resolutions in favor of it, and many legislatures have given it serious consideration. At least three bills in behalf of its adoption on a national scale were introduced in the British Parliament, previously to the one which recently passed the House of Commons. A few scientific men of good standing have favored the project, but the consensus of scientific opinion, so far as expressed, has been opposed to it.

The daylight-saving plan of advancing the clock one hour on a single date in spring and retarding it one hour on a single date in autumn, is the scheme which is beng tried in western Europe. So far as it applies to countries using standard time, it is equivalent to the adoption in each time zone, during the summer months, of the mean solar time of the central meridian of the zone next east of it. Opponents of the plan profess to see in it an abandonment of standard time, but the meridian of Greenwich still remains the foundation of the system.

In the United States, where winter daylight begins much earlier than it does in England and northern Europe, there have been advocates of the still simpler plan of using earlier time throughout the year. This idea has manifested itself especially in the adoption by certain communities lying near the boundaries of the standard time belts of the time pertaining to the belt east of them.

The whole subject is much more complicated than might appear at first sight. The duration of daylight in summer depends upon latitude. Opponents of the daylight-saving scheme in England have pointed out that there would be no advantage in adopting such a plan in Scotland, where people already have more daylight in summer than they can use. There is still less reason for advancing the clocks in Norway and Sweden, and that these countries have, as reported, adopted the new plan, or are favorably considering it, is hardly explicable except on the supposition that they wish to conform to Germany's newly inaugurated time.

The expedient of changing the clock in order to change people's habits has its pros and cons. Wherever standard time is in use, people have already abandoned the idea that the "time o' day" depends strictly upon the position of the sun in the sky. The process of altering the clock and retaining the present nominal hours for various daily events is undoubtedly much simpler than to change these hours nominally as well as actually. On the other hand, the alternate setting of the clock forward and back twice a year undoubtedly presents opportunities for much confusion. The conflict between scientific and popular requirements is probably not so serious as has been claimed in certain quarters. Astronomy and other sciences will continue to use the time best adapted to their needs.

A fundamental question, not yet satisfactorily answered, is whether a general change in the hours of people's daily activities is really desirable, or even practicable. In all civilized countries there is a tendency to keep later instead of earlier hours, and the daylight-saving plan appears to be a somewhat violent effort to combat the instinct, whatever it is, that underlies this tendency. A very large part of the population, including farmers and artisans whose work is carried on out of doors, is already compelled to utilize the early daylight hours. The rest of the population has apparently adjusted itself to an alternation of natural and artificial illumination that is perhaps analogous, in its psychical if not its physical effects, to the alternation of summer and winter, or to the warm and cold spells of a cyclonically-controlled climate. It remains to be proved that this adjustment is not a wise and wholesome one, and whether we should be justified in upsetting it for the sake of curtailing the cost of lighting.

Aeronautical Notes

The World's Altitude Record was broken on April 26 when Harry G. Hawker flew to a height of 24,408 feet in an aeroplane at Brooklands, England, according to an announcement made by the Royal Aero Club. Although Heinrich Hoelerich, a German aviator, attained a height of 25,756 feet in 1914, this feat has not been recognized by the Royal Aero Club.

New Battleplanes of the Italians.—A correspondent of the *Berlingske Tidende* who has visited the Austrian front reports that the Italian battleplanes are superior to those of the Austro-Hungarian forces, and that the latter have not been slow in realizing the fact. The large battleplanes of the engineer Caproni are specially marvelous and better than all other types. He goes on further to state that on the Isonzo front alone there are 80 of these huge machines, and the Austrians have not as yet succeeded in bringing down a single one.

New Speed Records in France.—In the *Journal* M. Georges Prade makes the following announcement: "On April 10 French aviation established new speed records. Needless to say, no exact figures can be published, so that we must perforce be content with stating that a new aeroplane, driven by a new engine, has beaten, on two occasions, all the previous world's speed records, not only for military machines, but also those set up in time of peace by machines which at that time did not appear to possess any military value."

Successful Raids on Constantinople by British Aviators.—On the evening of April 14, three British seaplanes flew over the Aegean Sea across the Sea of Marmora to Constantinople and back, a total distance of 300 miles, and dropped bombs on the Zeitunlik powder factory and on the aeroplane hangars. A fourth machine visited Adrianople and dropped bombs on the railway station. All four aeroplanes returned safely. Although the weather was fine at the start, adverse wind and a thunder shower were encountered later on. The powder factory blew up and the war office was hit, a great deal of damage being done. This raid was remarkable in view of the fact that the British aeroplanes are not up-to-date machines and their motors are very often unreliable.

An Enemy Opinion of the German Fokker.—In reply to a newspaper correspondent's request for an opinion concerning the German Fokker monoplanes, of which so much has been heard of late, M. Bleriot, the aviation pioneer, replied: "It is a very greatly overrated machine, and no better than the aeroplane we have had in France for a long time. I refer to Morane-Saulnier. The German machines are, without doubt, inferior to ours or yours, but they have an engine, the Mercedes, which is as good as, but no better, than the French engines. Never for a moment has Germany had the mastership of the air, and now that we have this machine we have established a lead which will never be wrested from us." The new machine referred to is called the "spad," and has a speed in excess of 125 miles per hour.

Remarkable Raids by French Aeroplanes.—On April 17, 22 French aeroplanes flew over the headquarters of the Bulgarian staff of Doiran at 3 A.M. and inflicted considerable damage. German aeroplanes attempting to defend the position were driven off by special rapid fighting aeroplanes of the French which made tremendous speed. Other French air squadrons bombarded the camp of the enemy at Strumnitza and Bogantizi the day before. There has also been great activity at Verdun, a French squadron of machines having dropped bombs on the railway stations at Conflans, Pagny, Arneville and Rombach. A French aviator, during the night of April 15-16, succeeded in dropping 16 bombs from a height of 300 feet on the deck of a German vessel on the North Sea. The war office reported that 11 of the bombs hit the ship, resulting in extensive damage.

The Dropping of Bombs on Washington and New York.—To arouse the populace, on the evening of April 16, aviator De Lloyd Thompson looped the loop over Washington and dropped numerous fireworks bombs. His aeroplane was illuminated with magnesium flares to make this exhibition. The bombs were dropped so that they exploded above the capitol and other public buildings. Aviator Thompson showed how easy it would be for aviators from an enemy fleet to swoop down upon the capitol and destroy it. He repeated his performance above lower New York and Brooklyn, on the evening of April 19, making a triple loop and performing astonishing gyrations. He dropped bombs over the Custom House and Whitehall Building. One of these failed to release and exploded while attached to the aeroplane damaging the fuselage and almost upsetting the machine. Aviator Thompson managed to resume control, however, and alighted safely on Governor's Island at 8:31 P.M. after having flown for 14 minutes.

Astronomy

Observations of Nocturnal Radiation were made in Swedish Lapland during the continuous darkness of last January by Dr. A. K. Angström, well known for his studies on solar and terrestrial radiation in this country and Europe.

Markings of a New Kind on Mars were observed at the Lowell Observatory at the recent opposition, according to note by Director Lowell. The new features appear to be secondary to the main canal net work. A tiny dot is seen within some of the polygons made by the intersections of certain canals, and from this extremely delicate lines extend to a corner and to the sides of the polygon. The effect is described as that of a centrally woven web, spun within the borders of the polygon, of a more minute order of tenuity than the polygon itself.

The Value of Meteor Observations is possibly even greater from a meteorological than from an astronomical point of view. This aspect of such observations is emphasized in the last report of the meteor committee of the American Astronomical Society, the chairman of which, Prof. Abbe, is the dean of American meteorologists. Meteors furnish information regarding the composition and movements of the atmosphere at levels far above those attainable by balloons. In this connection it is only necessary to recall the studies of Prof. C. C. Trowbridge, of Columbia University, on the drift of meteor trains; similar studies by the little band of British meteor observers, headed by the veteran Denning; and recent investigations by Dr. A. Wegener in Germany on the composition of the air at different altitudes as indicated by the solors of meteors.

The Discoverer of the Great Nebula in Orion.—The discovery of this object was formerly attributed to Huyghens, who describes it in his "Systema Saturnium," published in 1659. In 1854 R. Wolf called attention to an earlier description by J. B. Cysatus, of Lucerne, published in 1619. Cysatus saw the nebula as early as 1618, and possibly as early as 1611. The history of this greatest of all nebulæ is now carried still farther back by G. Bigourdan, who quotes in the *Comptes Rendus* from the manuscript journal of Peiresc observations of this nebula in November and December, 1610. Thus it appears that Peiresc made the first telescopic observation of a nebula of which we have any record. The earliest telescopic observation of the Andromeda nebula was made by S. Marius in 1912. Bigourdan is inclined to doubt the earlier observations of the Andromeda nebula with the naked eye, mentioned in most books on astronomy.

Arequipa Pyrheliometry.—Dr. C. G. Abbot, of the Smithsonian Astrophysical Observatory, has recently published a discussion of the pyrheliometric observations made from 1912 to 1915 at the high-level station of Harvard College Observatory at Arequipa, Peru. He states that "the Arequipa results confirm the variability of the sun, both from year to year and from day to day, shown by investigations at Mount Wilson and elsewhere." He suggests that if similar observations could be maintained at eight or ten favorable stations at high altitudes in various parts of the world the variations of the sun could be determined almost or quite as certainly therefrom as from two stations equipped for complete spectromolometric measurements of the solar constant. One interesting result of the Arequipa observations is that no effect upon atmospheric transparency was produced there by the dust from the eruption of Mount Katmai in 1912, though such effects were general in the northern hemisphere for more than a year after the eruption.

Astronomical "Bulls" are a sovereign antidote to the tedium of plodding *per aspera ad astra*, and their number appears to be unlimited; hence the astronomer has no excuse for being melancholy. Many delectable specimens have been recorded in our columns, and we are always glad to add to the list. From the current number of *Popular Astronomy* we learn that a certain newspaper, in describing the February solar eclipse, announced the time at which observers might see the "shadow" coming across the face of the sun. Since the sun is the source from which planetary bodies are illuminated, one wonders by what process the newspaper writer supposed that a shadow could be thrown upon this luminary. From a recent number of *Sirius* we learn that when the German astrophysicist, J. F. Krüger, died recently in Denmark, he was quite generally described in the newspapers of his own country as an "astrophysiologist." *Sirius* points out, however, that the term "astrophysiologist," although inapplicable in Krüger's case, is not so incongruous an expression as it appears to be at first sight. It applies very well to such persons as Prof. Adolph Marcuse, of Berlin, who has made a special study of errors in astronomical observations due to physiological defects in the observer.

Radio Communication

A New Wireless Record is believed to have been established, on April 26th, when the operator in the San Francisco beach station picked up a message stating the position of the steamer "Sierra," 4,870 miles out from that port on her journey to Sydney, Australia.

Australian Radio Service.—The Australian Minister for the Navy states that the Cabinet has decided that the whole of the wireless telegraph stations should be under the control of the Navy Department, and the new service will be called the Royal Australian Navy Radio Service. Those employed on shore will wear uniforms similar to the naval uniforms, with a slight difference in badges.

Weather Observations Reported by Radio.—At the request of the Weather Bureau arrangements have been made by the United States Bureau of Lighthouses for taking weather observations on the light vessels at Nantucket Shoals, Mass.; Diamond Shoals, N. C.; Frying Pan Shoals, N. C., and Heald Bank, Tex. These light vessels are all equipped with wireless apparatus by means of which observations may be transmitted to any point desired.

A New Wireless Station for Norway is announced in a recent issue of *Engineering*. The station is to be erected at Ooresiiter, and the contract for the work has been let to the Gesellschaft für Drahtlose Telegraphie of Berlin. The station, which will have masts 300 feet high, is intended for communication with the large European wireless stations. It is also proposed to erect a small station for shipping. It is expected that the new station, which will be equipped on the same principle as that at Nauen, near Berlin, will be ready in the autumn, and the cost will be about $110,000.

Work at the Mare Island Station.—The construction of the 300-foot towers for the new long-distance station at Mare Island, near San Francisco, is well under way. It is believed that when the 30 kw. apparatus is installed, the Mare Island station will be in constant touch with ships of the navy along the Pacific Coast as far as the southern boundary of Mexico. The station will also be able to communicate with land stations along the coast and with the Government station at Arlington, near Washington.

Wireless Communication Between Kentucky Mines. It is reported that two Kentucky coal mining companies are preparing plans for wireless telegraph service between several coal mines in Harlan County, Kentucky, and the main offices in Louisville. It is said that the sending station is to be located in the Black Mountains, where the Cumberland range reaches its highest elevation in the state. The receiving station will be on the Starks Building, Louisville. The distance on an air line is in the neighborhood of 200 miles, although by rail it is nearer to 300.

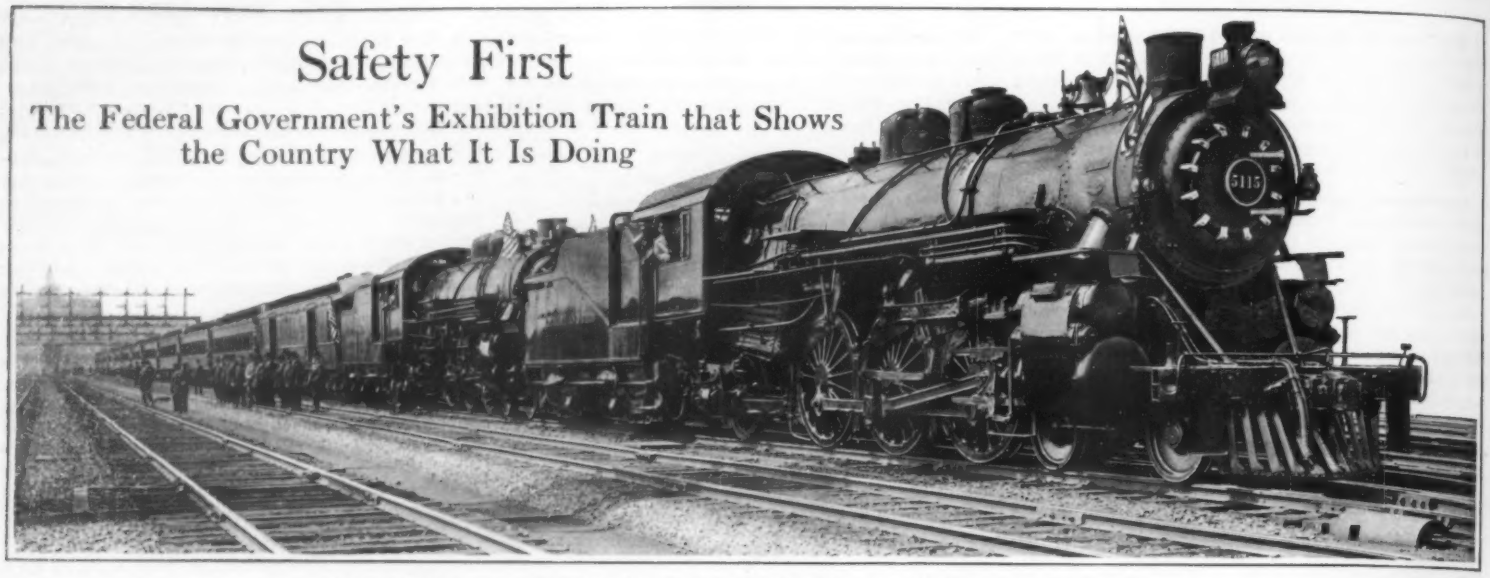
New Theory for Electrolytic Detector Operation.—In a paper presented by Prof. Wilder D. Bancroft before the recent Washington meeting of the American Electrochemical Society, an interesting theory is presented and offered for the *modus operandi* of electrolytic detectors, crystal rectifiers and coherers, namely, that electric voltage squeezes out, or at least in some way decreases, the thickness of the absorbed gas film, and thereby decreases the resistance of the detector. The paper is certainly welcome as a stirrer of opinions, comments the *Electrical World*, and as a gauntlet thrown to the advocates of thermoelectric action.

Radio Phenomenon Encountered in Mexican Campaign.—According to the *Wireless Age*, the wireless service men with the American punitive expedition into Mexico were surprised to discover that conditions in that country were exactly the reverse of those in the United States. In our own country the wireless operators find that the night time is much better for the transmission of dispatches. South of the border the day time is best. There is so much atmospheric disturbance at night in Mexico that wireless men prefer the day as a time for operating. This is not due to the altitude, which is 7,000 feet, but to the minerals in the mountains, especially iron ore.

A Concealed Wireless Telegraph Station which exists in some part of Brussels has caused much annoyance to the local German authorities because of the fact that it has furnished the people of Belgium with war news which the Germans desired to keep from them. According to reports, the search for the station has thus far been unsuccessful, although as an added incentive a reward of $2,500 is being offered for information that will disclose the location of the troublesome plant. Since the wireless station appears to be used for receiving messages only, its detection is extremely difficult and resolves itself into practically a house-to-house search; but if the station were also used to transmit messages, its apprehension would be a simple matter.

Safety First

The Federal Government's Exhibition Train that Shows the Country What It Is Doing



The Federal Government's safety first train leaving Washington on its tour of the Central States

A FAR-REACHING result of the recent Safety First Exposition, held in Washington by the Federal Government to show what it is doing toward the saving of life and property, is to be found in the efforts now under way to bring this material to the attention of the country at large. The Baltimore and Ohio Railroad Company has coöperated with the Department of the Interior in this, to the extent of furnishing, without charge, a 12-car, all-steel train, to accommodate the more significant features of the exhibit. This train is being hauled over the entire B. & O. system, stopping a sufficient length of time in each city or town to enable the residents to inspect thoroughly the various exhibits.

After an inspection of the train by President Wilson, the start was made from Washington, on May 1st, in the presence of Secretaries Redfield, Lansing, Daniels, Lane and Baker. The itinerary for the first month included one-day stops at Chester, Pa.; Wilmington, Del.; Frederick, Hagerstown and Cumberland, Md.; Winchester, Va.; Martinsburg, Grafton, Morgantown, Fairmont, Clarksburg and Parkersburg, W. Va.; Marietta, Athens and Chillicothe, Ohio.; Vincennes, Washington and Seymour, Ind., and East St. Louis, Ill., with stops of two days each in Philadelphia, Baltimore, St. Louis, Louisville and Cincinnati. After completing the tour of the B. & O., arrangements are to be made to take the train over the other trunk lines of the country, so that every citizen who cares to do so may see just what his Government is doing for him.

The exhibit of the Public Health Service of the Treasury Department touches the people about as closely as any. By charts and models this branch of the service illustrates its methods of dealing with epidemics, and substantiates its claim that the freedom of the United States from typhus, cholera and yellow fever is mainly due to the efficiency of its quarantine. Methods of protection of food, water and working conditions are demonstrated which go far toward accounting for the low death rates of our large cities.

More direct activities in the saving of human life, although not of nearly so wide application, are those exhibited by the Coast Guard. Life boats, life-line guns, breeches buoys, wireless outfits are some of the implements employed by these courageous men and to be seen in the exhibit of their activities. Likewise, the Bureau of Mines has on display a complete set of apparatus for saving and conserving the lives of the miners. The American Red Cross Society shows how it goes into the factory districts and teaches the workmen the principles of first aid to the injured. Even the Weather Bureau makes it clear what part its storm warnings play in saving lives by keeping vessels out of dangerous regions, or in giving dwellers in the river bottoms warning of approaching floods.

Car devoted to the Red Cross and the Coast Guard

Perhaps of less human interest, but of no less necessity, is the work of the bureaus which conserve not lives, but property and resources. The Forest Service shows its methods of prevention and extinction of forest fires. The Reclamation Service illustrates its activities in bringing fertility to the waste places and making them habitable by man. Among the exhibits of this bureau are many colored transparencies and moving pictures bearing upon the reclamation of 40,000,000 acres of land in the great American desert.

As a part of a truly American safety first program, the Departments of War and Navy have tried to show by means of a collection of models just how we are prepared to deal with a foreign foe. The turrets of the great battleships are here in miniature; there are machine-guns and representative types of warships, torpedoes and signal stations, all well worked out. Few people will be able to come away from this train without finding something to interest them and to enlarge their ideas of the scope of the activities of the Federal Government.

Japanese Patent Rulings

COMPLAINTS have recently been made that the Japanese, in patent and trade-mark matters, are not construing their laws and rules of procedure in favor of foreigners in the same liberal manner that is done where the rights of Japanese are concerned. As these complaints have come from people thoroughly familiar with the actions of the Japanese Patent Office and other Japanese tribunals, it appears to be necessary that they receive attention.

It would seem that the complaints have been occasioned by a misguided desire on the part of some petty officials to further the interests of Japanese at the expense of foreigners doing business in Japan; and it is, therefore, believed that, as was the case a few years ago, the trouble will be cured when those in authority realize the due significance of the rulings that have occasioned the complaints.

Interior of car containing the exhibit of the Bureau of Mines

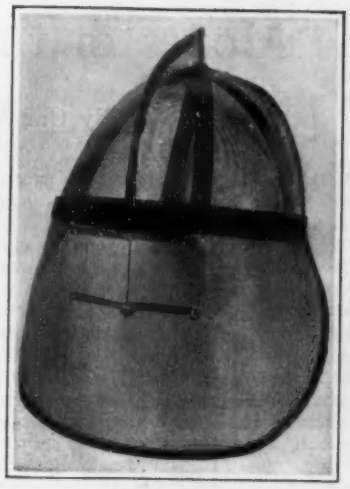
Navy Department car, with preparedness exhibit

Helmets Worn as a Protection Against Dangerous Dusts

DUST of all kinds is a menace to a worker's health, especially if it is laden with metallic or sharp particles. So it is that among the dangerous occupations of the present day, sand-blasting is well in the foreground, although devoid of the spectacular. The manager of a well-known Eastern foundry recently stated that "a sand-blaster lasts about five years, rarely any longer." After that time the millions of sharp particles of sand have practically sand-blasted his lungs.

If the sand-blaster is to be protected against the bombardment of the myriads of sand particles, it is essential that he be provided with some suitable form of respirator or helmet. The former has been in use for years past, but the latter is only now coming into greater use. An American firm recently completed a series of tests in order to determine: first, the force of the impact and the abrasive energy created by sand-blasting; second, the fineness of the sand after it has struck the casting; third, the properties of the sand after it rebounds. As a result of the knowledge gained, there has been designed a helmet which is said to meet all the conditions encountered in the work, and which affords protection for the eyes, ears and lungs.

Hood used as a protection against dangerous dusts



Mask worn by workers engaged in babbitting operations

Four shields of multiple metal screens admit air and light, but form an impenetrable barrier between danger and the man wearing the sand-blaster's helmet. A frame holds the hood away from the head to form a 2-inch air space all around, permitting of the free circulation of air; thus hot, stagnant air cannot collect inside the hood. The multiple screens are of sufficient toughness to resist the blow of the sand, while the frame, although light in weight, is very strong. The hood will withstand the hardest kind of wear.

In conjunction with the sand-blaster's helmet, a hood of light material may be fitted over the same frame. This hood drops to the neck of the wearer, where it can be tightened by means of a drawstring. A window, which may be either transparent celluloid, mica or glass, permits vision. Free circulation of air within the hood is facilitated by six ventilating screens in the top and four in the skirt. In babbitting operations the same head frame is again used, this time to support the wire mask on the head. The mask is made of three parts. Two parts of semi-spherical shape form the cap. A ridge or comb where they join adds rigidity. The apron, dropping to a point considerably below the chin of the wearer, extends in width around one third the circumference of the head-frame, therefore reaching almost from ear to ear, and giving ample protection from the splashing metal. An added protection for the eyes are the two squares of heat-treated glass.

The multiple screens used in the helmets and hoods consist of a number of metallic screens of very fine mesh arranged in suitable combination. These devices take the place of respirators and goggles in the instance of the dust hood, and permit men to work in places filled with lampblack dust, carbon flour, lead dust, oxide of iron, and other dangerous dusts, without injury to health. The advantages of the helmet and hood over respirator and goggles is that they are more comfortable to wear since nothing touches the wearer's face, and that aside from protecting the wearer's lungs, his ears and hair are likewise safeguarded.

Bonding or joining electric railroad rails together by means of an electric arc

An Electric Truck Which Carries Its Own Elevator

TO speed up trucking methods in plants working at full capacity to meet the demands of the new era of industrial prosperity, a combination truck and elevator has been placed on the market. At this writing it is being installed in fleets of 50 or more in some of the larger plants. One man can operate it and accomplish the same work that ordinarily requires the services of from five to ten men.

The truck is gear driven, and is equipped with a platform which may be raised or lowered by a special electric lifting device driven by an individual motor taking power from the truck battery. The platform will elevate a load of 4,000 pounds 3 inches in 7 seconds, and the truck loaded to capacity can convey the load to its destination at a speed of 5 miles an hour, and there deposit the loaded platform.

In plants where it is now installed goods are placed on platforms in various parts of the building, and are moved at a minimum expense of time and labor by the truck. If desired, the truck can be used for ordinary trucking purposes, or it can be used as a tractor to haul ordinary trailers from place to place. It is constructed of I-beams, steel castings, and drop forgings, and the controller is of the vertical type with three speeds forward and three in the opposite direction. The control of the lifting device is automatic, and when it is desired to drop the load this can be done in from three to five seconds.

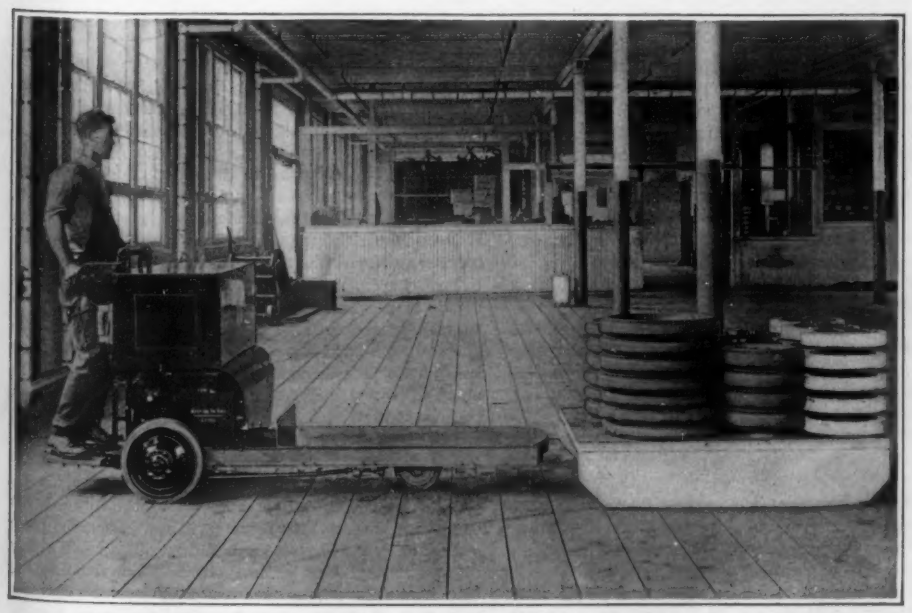
Making Railway Rails Continuous by Means of the Electric Arc

A CONTINUOUS conductor is obviously more efficient as a path for an electric current than one made up of a number of sections more or less securely joined together. This, then, is the reason why electric railroads spend large sums of money in joining or "bonding" their rails together, for the connecting plates used in joining mechanically the ends of two rails form but a poor electrical connection; and when it is borne in mind that these joints occur every 30 or 40 feet, it becomes apparent that the aggregate resistance in a mile or more of track is tremendous.

Heretofore the bonding of rails has taken the form of small copper cables or strips connecting together two adjacent rails. But since the ideal, both from a mechanical and electrical viewpoint, is a continuous rail, in recent years the railroads have been resorting to various methods of welding, to a greater or lesser degree, the rails together, using the casting process, thermit, or electricity. The latter has been accomplished by two distinct methods: first, the resistance method, in which a heavy current is caused to pass through a poor joint between the rails, the resistance of which heats the steel to a point where the metal actually runs; second, the electric arc method, in which the joint is heated to incandescence by an arc drawn between the rails and a carbon or metal electrode. The latter method is perhaps the most common in present-day practice.

A typical arc welding outfit for rail bonding aver-

(Concluded on page 626)



Combination electric truck and elevator about to run its platform under a load of rubber-tired wheels

Electric truck after lifting up the load clear of the floor, ready for its trip

Strategic Moves of the War, June 2nd, 1916

By Our Military Expert

ONE of the most consistently noticeable things of the Euporean war is the way in which the general staff of the Central Empires never overlook anything in either the situation or in the art of war. For years it has been conceded in a general way that the German army was the best in the world in point of organization as well as discipline—a veritable, cold-blooded fighting machine. But the war has made this generalization most specific.

This is apropos of the Entente force collected in an out-of-the-way spot on the map, Saloniki, into which vicinity its nucleus was driven during the clearing of Serbia when a belated attempt to aid this small ally was made.

After many months of talk regarding the imminence of the launching of a general offensive by the Entente Powers, every indication, reasoning as well, began not many weeks ago to point to its inauguration with the coming of propitious weather in the current spring. As the initiative in war means much to the side retaining it, Germany, at the most auspicious moment, and realizing the preponderant numbers against her at this phase of the war, promptly blocked the Allies' little game by the opening at Verdun of the most stupendous battle-siege the world has ever witnessed. Germany took hold at this point; and, with eminent military sagacity and tenacity, has not let go even though there now appears small likelihood of a tactically successful decision accruing to her; but as long as Germany can continue her assaults at Verdun, the initiative remains with her.

General Cadorna, the Italian generalissimo, paid an important visit to Paris to consult with the members of the Allied council and reports were freely circulated that the Italian army was about to arouse itself and press forward. The next thing the dispatches recounted was the heavy Austrian attack in the Trentino, driven home by the hammering of a superior artillery. The Italians—and their Allies—were again forestalled and the former are extremely busy meeting the threat to the Venetian section of their land.

After the withdrawal of the Allied forces from Serbia, diplomatic necessity became the deciding factor in halting Teutonic pursuit at the Grecian border. There existed—and exists to-day—a powerful war party in this ancient nation of Athens, which held that the destinies of Greece must coincide with those of the Entente. The court party, of decidedly pro-Teutonic leaning, resisted the popular demands and on the plea of preserving strict neutrality, through holding the reins of government has been able to keep the Greek forces from under the standards of the Entente. The national situation was complicated by the affiliation of the Bulgars—frankly inimical to Greece over the question of Macedonia—with the Central Empires. Diplomacy intervened for fear of boiling the kettle over and as a result, Greece presented the odd spectacle of maintaining technical neutrality toward the Kaiser while she, of necessity, paid part of her treaty obligations to his enemy by permitting the use of a section of her territory by the Entente.

The comparatively slender Entente forces which occupied Saloniki after the retirement from Serbia have been vastly increased since that time. In addition to the French and British troops which compose the bulk of the force, more than 100,000 Serbians, armed and re-equipped by the Allies, are now present within the lines. It is impossible to say with any degree of accuracy what the total force may be, but compilaton of various reports received in this country since the occupation of Saloniki lead to the belief that from 500,000 to 600,000 men is not far wrong.

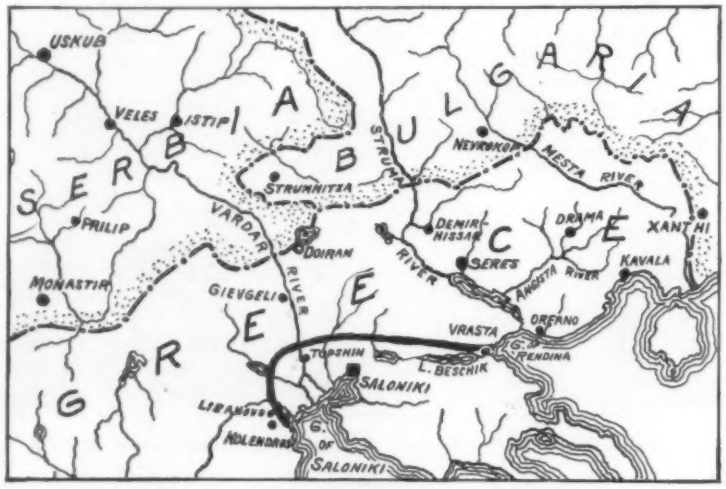
Call it the lesser number. Even in this war of grand arithmetic a distinct and concrete army of half a million men is a very powerful force—in this case powerful enough to initiate an offensive thrust northward against the railway from Germany and Austria to Turkey and Constantinople. It establishes a very real threat, a thorn in the side of Teutonia, for it is fairly on the strategic flank of its communications, and rather near at that.

This force has certainly not been gathered at Saloniki merely to occupy Grecian territory; no such preparations as have been made for its adequate maintenance would have been completed for such a purpose and the deduction is very easily made that the greatest object of the force is to undertake such a northward thrust when the time and circumstances are promising to success.

Again: reports have indicated for some time that activity was about due from Saloniki. But the German staff, realizing that diplomacy has won its all by holding Greece inactive as long as it has and that there would be nothing to gain once the Entente should begin an advance, has removed the leash from the Bulgarian war dog and to seize better and more advanced defensive positions against the day of battle, has permitted Bulgaria to cross into Macedonia, seize Greek defenses and obtain a foothold upon her desired land, ignoring the factor of possible Greek participation against her as a result—or else Berlin must have a very thorough understanding with Athens.

Teutonic and Bulgarian troops advanced a short distance along the River Mesta, at Xanthi, and toward Demir-Hissar, while it is reported that strong concentrations of troops have been made near Doiran and Nevrokop.

The lines of Saloniki are of two general classes, the advanced positions and the line of defense. The latter is a very obvious one and makes for economy of manning. It begins on the east near Vrasta, on the Gulf of Rendina, or Contessa, or Orfano—take your choice—and follows the line of the river which is the outlet of Lake Bashik. The lines now lie north of the lake, but should necessity compel a retirement, this lake and its smaller neighbor more to the westward form excellent and firm points of rest to the general line. In the vicinity of the railway to Gievgeli which



The region about Saloniki, showing the line of defense

is crossed by the main line of defense there are a number of eminences which form excellent positions of defense. The line crosses the Vardar at Topshin, proceeds approximately ten miles farther west, then turns abruptly southward to end securely on the Gulf of Saloniki in the vicinity of Libanovo and Kolendros.

From this entire line northeast, north, northwest and west the advanced positions occupy the ground to a considerable distance. To the northward are broken ranges of hills and mountains whose passes and crests must be forced ere General Sarrail's force can materially advance toward the Teutonic communicatons with Turkey, and it is to prevent the occupancy of these hills by the Allied forces that the Bulgarians have moved forward.

Soon after Saloniki was occupied in force by the Entente, comparison was drawn in this column between the present situation and the lines of Torres Vedras in the Peninsula campaign when Wellington, beaten back by the armies of Napoleon, established himself about 30 or 40 miles north of Lisbon with his right on the Tagus while his left lay securely upon the Atlantic; and all the assaults directed against him failed to shake his hold. When the time was ripe, he turned upon Massena and drove him to the defeat which eventually resulted in the downfall of Napoleon.

To return to the theme; for the third time the Teutonic staff has forestalled—or possibly anticipated—an offensive movement on the part of its enemy. And while the great struggle has continued for weeks on the western front, this same staff has found it expeditious to take offensive action.

It may reasonably be expected that Russia's turn will come; but the problem should be harder on account of the vast extent of the Russian line from Riga to Roumania. It may come toward Riga, Dvinsk, Minsk or Rovno, the most important railway junctions of the entire line. And if it comes, it will probably be found that it almost exactly anticipates the assumption of the offensive by Russia. But Germany has less to fear there than elsewhere, for reports of conditions indicate that while Russia is actually far better off in a military way than at any time since the war began, she is nevertheless not yet prepared to undertake her general forward movement in full strength to promise success. Her easy sweep in the beginning of the war was possible because her mobilization was consummated earlier than the German staff expected, when Germany's hands were occupied with the throat of France.

The Balkan theater of war is well worth watching. No one can tell where the first major diversion on the part of the Entente will occur and it may easily be a joint one participated in by Sarrail's force thrusting to the north while Russia strikes southward.

The Physics of a Smoke Ring

By Leigh F. J. Zerbee, 2nd Lieut., C. A. C., U. S. A.

IN the firing of large caliber mortars the spectacular smoke ring is of rather common occurrence. To the layman it is simply a beautiful and interesting sight to be watched until it disappears in the clouds. However, when an artilleryman sees one issue from the muzzle of his piece he expects that particular projectile to fall short, and unless other conditions make a compensating error his judgment will be correct. From the foregoing it is to be understood that this phenomenon is undesirable. The following is offered as an explanation of the cause of the smoke ring:

Every one is familiar with the appearance of the modern projectile, a long, cylindrical body with a flat base at one end and a point at the other. Just forward of the base and encircling the projectile is the rotating band. It is made of annealed copper. The powder chamber of a mortar is of larger diameter than the rifled portion of the bore, consequently the chamber and bore must be connected by a cone. The after part of this cone is unrifled and is called the centering slope. The forward portion is rifled and is known as the forcing cone. The rotating band is turned to the same surface as the cone in the gun and when the projectile comes to rest in the bore, after having been rammed, a gas tight joint is effected between the gun and the projectile. Thus the rotating band here is in reality a valve and the centering slope its seat. Projectiles are rammed with all the force available so as to seat them securely and make an absolutely gas tight joint. After the ramming of the projectile the powder is loaded and the breech closed. At the time of the explosion a great pressure of gas is formed behind the projectile which causes it to move forward, flowing the copper band down into the grooves of the rifling and preventing any escape of gas. If gas does escape, due to improper seating, dented or otherwise mutilated rotating band, or other reason, the pressure acting on the projectile is lowered and the shot will fall short.

This leaking of gas past the rotating band is the cause of the smoke ring. It takes position in front of the projectile in the form of a smoke piston and is pushed from the bore by the projectile. Even though this piston of gas while in the gun is forward of the projectile, still, due to the rapid motion of the projectile, it is under greater than atmospheric pressure. When it issues from the muzzle it immediately expands, according to Boyles Law, and the next instant is pierced by the charge. This changes the smoke piston to the smoke ring. The queer "turning inside out motion" they have is caused by the charge going through the ring and its friction against the inside of the ring setting up a rotation. A similar motion may be obtained by placing a small rubber band around a broomstick and pushing it along the stick by the hand which at the same time loosely grasps the stick.

The fact that the ring continues to increase in diameter as it rises is probably due to the kinetic energy given to it in that direction by the force of the expanding gasses at the muzzle. It rises from the piece at first swiftly and then more slowly. The rapid rising at first is explained by its velocity from the mortar; this soon dies off, however, and its ascent continues by reason of the fact that it possesses a lower specific gravity than air.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Open Sights vs. Peep Sights

To the Editor of the SCIENTIFIC AMERICAN:

Articles on the above have appeared in your issues of Dec 11, 1915, January 22, 1916, and April 15, 1916. These articles are by Mr. Crossman and Mr. Winans. Mr. Crossman states that the peep is quicker than the open. He also states that the open sight is used when in a great hurry. These contentions appear to contradict. He states that the peep is ignored. He also states that the peep must be found, that the head must be placed in the right position so as to look through the peep, that the peep must be looked through at the outset. These contentions look very much like further contradictions. It certainly does not seem possible to ignore the peep, and at the same time search for it.

Mr. Winans states that the peep is useless in poor light, which lasts about half the time. Mr. Crossman does not deny this statement, hence must be taken to have admitted it. The same thing applies to Mr. Winans' statement that the peep is useless for moving targets.

Neither Mr. Crossman nor Mr. Winans states how useless the peep would be in the mud and slush of France and Belgium.

The reason why the open sight is used when in a hurry is that the target, the front sight, and the surroundings are never lost sight of, as Mr. Winans states. On the contrary, when the peep is used the front sight, the target, and the surroundings are lost to view from the time that the plate which contains the peep comes before the eye until the peep is found, the head got in the right position, and the peep is looked through. After these things have been accomplished, the front sight must be searched for and found, the surrounding country must be searched over and the target found. When all these tasks have been performed the gun must still be sighted.

When in a hurry, when the light is poor, and when the object is moving the peep is manifestly unfitted for use. Unquestionably, the peep, when it can be used, is more accurate than the open sight. The telescope is more accurate than either, but that fact would not justify the general use of the telescope.

The accuracy of the peep induced both Americans and Canadians who were after mere amusement at the target to adopt the peep. The hope of securing trophies by somewhat questionable methods, that is, by the use of sights unsuited for war purposes generally, induced both Americans and Canadians to adopt the peep in foreign competitions.

Mr. Crossman speaks of accuracy. He also advocates the use of a battle sight, which does away absolutely with anything resembling accuracy. His two positions on accuracy seem at least queer. What would be thought of a man who started out to hunt game with only a battle sight on his gun? The man who would do it would certainly be considered a little peculiar. Precisely the same thing applies to hunting men.

The meaningless term "flat trajectory" appears to have led some men astray. There never was and never will be a flat trajectory.

As to accuracy of guns, which is another meaningless term or phrase, no gun is accurate. No gun can be sighted. Sighting is mere approximation. I do not refer to battle sights, which are never intended to be sights at all. Curiously, neither those who make guns nor those who use them seem to desire that guns should be more nearly accurate than they now are, though they could very easily be made more nearly accurate.

C. C. GRANT, M.D.

Box 422, Red Deer, Alberta.

Possibilities of the Transatlantic Flight

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 6th is presented, in a letter in the Correspondence Column, by George Lanzius, an elementary proof that the "average machine" cannot fly across the Atlantic in a non-stop voyage. "These figures," it is stated, "prove conclusively that the non-stop flight across the Atlantic is beyond the present possibilities."

The writer concludes by censuring Mr. Curtiss for lending his name to such a project. "It is inconceivable to me," says he, "that any persons having even a slight knowledge of aerodynamics would lend their names and endorse such an undertaking."

Permit me, by use of the writer's method of argument and somewhat better data, to prove the possibility of a non-stop flight across the Atlantic. Mr. Curtiss says he can build a 3,600-pound flying boat of 600 horse-power, using .55 pounds of fuel per horse-power. The weight per horse-power is, therefore, as follows:

Fuel for 30 hours.....	16.5	pounds	per	horse-power
The machine.....	6.0	"	"	"
Two pilots.....	0.5	"	"	"
Total.....	23.0	"	"	"

This 23-pounds load requires $23/6 = 3.83$ pounds thrust per horse-power, whereas a propeller of 100 per cent efficiency can exert a thrust of 5.36 pounds at 70 miles per hour, the assumed speed. The ratio, $3.83 \div 5.36 = 71$ per cent, is, therefore, the necessary propeller efficiency in Mr. Curtiss's proposed craft. But he can build propellers having greater efficiency than is here found necessary. Furthermore, it is not necessary to fly at 70 miles an hour for 30 hours, since the proposed route to Ireland is only 1,800 miles long.

Having proved from the data supplied by Mr. Curtiss that the non-stop flight is possible, I may remark that he is not pledged to such a flight with the machine above referred to, but has made provision for stopping en route for supplies from a ship.

It thus appears that Mr. Curtiss is not, for want of "a slight knowledge of aerodynamics," venturing upon an ill-considered or a preposterous enterprise. On the contrary, he has an aerodynamical laboratory of his own, a technical staff of trained and experienced aeronautical engineers, and has had himself the largest practical experience of any man in America in the construction of varied types of aircraft.

A. F. ZAHM.

Buffalo, N. Y.

The War Game Series

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to thank you for your attention in the matter of the war game. This project, undertaken by a publication of the standing and circulation of the SCIENTIFIC AMERICAN, while in a way a novel departure for any other than a service magazine, is worthy of great commendation as educating your readers in a matter of such great present importance. Any student of the war game will receive a very excellent idea of the methods and procedure of modern military practice, and he is bound to derive considerable instruction along the lines covered. The military students, for example, officers and men of the National Guard, or members of the Business Men's Training Regiment, who are pursuing military studies should find the course covered by your war games of very material assistance in their work. In my opinion, the SCIENTIFIC AMERICAN, in thus presenting such a game, performs a great public service.

JOHN F. O'RYAN,
Major General.

Headquarters Division, National Guard, New York, Municipal Building, New York.

The Battle of the North Sea

NOT until the detailed reports of Jellicoe and Beatty are made public will it be possible to write the technical story of the great Battle of the North Sea, or the Battle of the Skagerack, as it may possibly be called. The earlier German official accounts, following the policy of concealment of losses as practised by the army, have proved to be unreliable, although later dispatches admit the loss of additional ships to those given in the first radiograms to Sayville.

The outstanding fact, at least for the casual student, is the closeness with which the theories of naval construction and naval tactics were verified. The various types of vessels engaged on both sides were maneuvered, fought, suffered or won, exactly as the text book had foreshadowed.

Briefly stated, the Battle of the North Sea was a first-class engagement, resulting from a hostile demonstration against the German High Seas fleet on the German side of the North Sea, in which after serious, and (as it now begins to apear) approximately equal losses on each side, the German fleet was driven back into its home ports, leaving the command of the sea to Great Britain.

It is evident that both the British and German main fleets were out in force. The descent of the British on the German coast were carried out in conformity with the conventional disposition of a fleet that is seeking the enemy. In the van were the fast scouts and destroyers. Back of these were the battle-cruisers and armored cruisers (though what these relatively slow, lightly-armored and lightly-gunned ships were doing in company with the battle-cruisers is puzzling); and far to the rear (too far as the event proved) was the main force of British dreadnoughts.

The disposition of the German fleet was similar, with the important exception that their main battleship fleet was in close touch and well up with its screen of scouts and battle-cruisers—as the British battle-cruiser fleet was to discover before the engagement had been long in progress.

The scouts and destroyers of the two fleets were the first to make contact, and at once they fell to with the characteristic dash of these vessels. Next the battle-cruisers became engaged; and Admiral Beatty pushed forward at full speed in the effort to place himself between the German battle-cruisers and their base—the Kiel Canal or the Bight of Heligoland, as the case might be. The maneuver promised to be successful; but while he was hotly engaged with the German battle-cruiser division, which was apparently to starboard, there loomed up to port the main battle-line of the German dreadnought battleships.

Probably the situation was of the German admiral's making; for it is known that he was assisted by one, and, according to neutral testimony, several Zeppelin scouts. It is fairly certain that, due to superior information, the Germans had a far more accurate knowledge of the strength and position of the British than the British had of the German forces.

It was during this phase of the engagement that the British losses occurred. The battle-cruisers and armored cruisers, with their relatively light armor, were overwhelmed by the broadsides of the combined battle-cruisers and battleships of the German fleet. Three British battle-cruisers, the modern "Queen Mary," mounting 13.5-inch guns, and the older "Indefatigable" and "Invincible," were blown up by internal explosions and sank. Whether the blowing up was due to gun-fire or the torpedo has not, at the present writing, been reported. The 9.2-inch guns and 6-inch armor of the armored cruisers "Defense," "Warrior" and "Black Prince," were powerless against the German dreadnoughts, and they also were sunk.

Meanwhile, in answer to Beatty's wireless call, the British battleship fleet was coming up as fast as forced draught could drive it. The first to arive were the fast 25-knot 15-inch gun battleships of the "Queen Elizabeth" class; and we shall not be surprised to learn that these ships were the only British battleships to get into the fight. If so, we have here another striking evidence of the great tactital value of speed; for it was the British battleships which turned the tide of battle, drove the Germans back, and sent them in full retreat to the shelter of their mine fields.

That it was the "Queen Elizabeths" that turned defeat into victory, is strongly suggested by the fact that the battleships which the Germans claim to have sunk—the "Marlborough" and the "Warspite"—are of this class. Both ships, by the way, returned to their home ports.

In their first announcement of the battle the Germans admitted the loss of only one capital ship, the "Pommern"; though what this old pre-dreadnought was doing in the first dreadnought line is hard to imagine. She was believed to have been lost many months ago in the attempt of the German pre-dreadnought fleet on Riga in the Baltic. Was she lost then, and acknowledged now in place of a first line-ship—a dreadnought?

The list of German losses shows a tendency to grow. A dispatch from Berlin admits the loss of the "Westfalen," an 18,000-ton dreadnought of the "Nassau" class. A strong suggestion of further losses in capital ships is found in Admiral Beatty's statement that, while pursuing the German fleet, he saw a German battle-cruiser blown up; that later he passed another battle-cruiser which was aparrently mortally hurt, and that on returning, he failed to find any trace of her.

There is a persistent rumor from neutral sources that the latest German dreadnought battleship "Hindenburg" was sunk; but neither the British nor German admiralty mention her, and at present the reports lack verification.

In capital ships of the first class, then, the British have lost three battle-cruisers and the Germans, a dreadnought battleship; one and possibly two (according to Beatty's report) battle-cruisers, and a pre-dreadnought battleship.

In secondary ships the British lost three rather old armored-cruisers, and the Germans four new fast scout cruisers and two older cruisers.

Of destroyers, the British lost eight and the Germans nine. The Germans also lost one submarine.

The total tonnage loss for the British is 114,100 tons, the tonnage loss for the Germans is 70,515; and if, as Beatty's report indicates, two German battle-cruisers were lost, their total tonnage loss is 100,515 tons.

The British loss in capital ships is 63,000 tons, the German loss is 57,000 tons, or, if two battle-cruisers went down, it is 81,000 tons.

The outstanding fact of the Battle of the North Sea is that the British fleet engaged and drove the German fleet in flight back to its coasts, suffering in the engagement losses which so far as available information goes were equal to those of the enemy.

If the losses were equal, the British fleet is to-day relatively stronger than it was before the fight—if its losses, as the Germans state, were heavier, the relative standing of the two navies remains the same. In the first case the grip of the British navy through blockade has been strengthened, in the second, it remains as before.

From Herring to Halibut

Strong Measures Necessary to Keep American Fishermen from Being Driven off the North Pacific Banks

By Monroe Woolley

AS a big-fish industry halibut is perhaps second to salmon in the vast fishing grounds of the Pacific Northwest. Federal and State fisheries departments are taking unusual interest in this growing fishing field with a view to enlarging and marketing the catch.

The halibut is the largest species of the flatfish family, or flounder. A distinctive peculiarity consists in the fact that both eyes are on the same side of the head. One side of the fish is colored, the other is almost snow white. The halibut grows to great size, and often weighs from 300 to 400 pounds. The meat is fat, tender and delicious, and there is a delightful absence of annoying bones. Halibut steaks are especially appetizing. But unlike salmon, halibut has not yet found its way into cans. Therefore its market is limited, and citizens living inland rarely, if ever, meet it. However, the halibut industry is growing rapidly, and as the fishing fields are enlarged, new ways of marketing the food are bound to follow, so that in time halibut may find its way into all parts of the country, without resort to refrigerator cars and other expensive methods of shipment.

The Department of Commerce is doing all it can to keep the fishing industry of the North Pacific in the hands of American interests. Seattle has always been the headquarters and base of the American halibut fishing fleets, but as the bulk of the halibut is taken on banks in Alaskan waters, it is necessary to make a long sea trip to land the catches there. Prince Rupert, British Columbia, is 500 miles nearer the Alaskan halibut banks than is Seattle. The completion of the Grand Trunk railroad has given the fishing interests a scare, for they fear Prince Rupert will become the halibut headquarters, not only for Canadian fishermen, but for Americans as well.

Ketchikan, Alaska, has been used as a base by the Alaskan fishermen who wish to avoid the long haul to Seattle. But Ketchikan has been quite unable to compete with Prince Rupert since the latter port has acquired railroad connection. Alaskan halibut fishermen have just appeared before State and Federal fisheries departments pleading for aid in saving their industry from destruction by Canadian competition. But Secretary Redfield, according to press reports, had declined to suggest legislation putting a tariff on halibut imported into the United States from Canada.

As their only means of salvation the Ketchikan business men have asked the Grand Trunk officials for terminal rates from Ketchikan to any point on the continent the same as charged from Prince Rupert. If the officials agree to this request, and Prince Rupert will show the same consideration to American halibut fishermen as is shown the Canadians in the way of prices on ice and other supplies, it is possible that a part of our big halibut fleet will continue to make Ketchikan a home port, for Alaskan operations at least.

In any event Seattle is bound to lose much of the business heretofore brought by the Alaskan halibut fleets. To meet this situation the Federal Government has gone to much expense to locate new halibut fields nearer Seattle. The Government steamer "Albatross," working with a crew of expert halibut fishermen aboard, has located new and extensive halibut regions off the Oregon and Washington coasts, close to American ports. In 1915 nearly 1,000,000 pounds of halibut were taken from one of these areas. New banks have also been discovered off the mouth of the Columbia River where none were supposed to exist, and certain other banks with commercial possibilities have been definitely located which were hitherto known only by rumor.

Rough weather on the halibut banks

It may be said, according to official report, that a new source of halibut supply has already been developed, and that this same source will be of even greater value in the future for a supply of other fishes not now in demand. In fact, so good are these newly-found banks off Washington and Oregon that usually but from two to four days are required to fill the steam fishing schooners with cargoes. This halibut harvest comes to Seattle instead of to Prince Rupert, and hundreds of small halibut fishermen, and some of the steam fishers, have abandoned the Alaskan fields for the new ones off shore at home.

A movement is afoot to have the Federal Government continue these surveys for new halibut fields nearer home by chartering two regular halibut fishermen manned by their regular crews. It is claimed that these boats can do the work better and at a smaller expense than can the "Albatross." All the fishing industry wants Uncle Sam to do with the chartered boats is to determine the location and extent of shoal waters. The fisherfolk will themselves quickly determine whether halibut can be taken in commercial quantities, saving the Government the expense of this work.

At one time there were extensive halibut banks just outside Cape Flattery, but these banks have long since been fished out. Hence, halibut fisherfolk were driven to the bountiful, though distant fields, in Alaskan waters. The experimental operations of the "Albatross" in looking for new fields nearer American markets took the vessel 300 miles due west of the Washington cape, and thence south toward the mouth of the Columbia.

If it were not for herring many of us would go halibut hungry, for it is herring, used for bait, which entices the halibut to take the hook and thus find his way to the butcher's block. This affords us our one advantage over the Canadians in the halibut fishing industry. Puget Sound yields the best and biggest bait supply in the world. Much of the herring bait for the entire halibut industry of the Pacific comes from this source. Herring are taken largely in winter, and the catch is frozen to be preserved for use as bait in the summer. Just now the fishermen are annoyed over a law which prevents their taking herring, even for bait, with seines. Overtures are being made to the Washington State Fish Commission to have this law modified.

Halibut fishing is generally a dangerous business. The fishing crews of the steam schooners operate in dories, much as the fishermen do on the Grand Banks about Newfoundland. Their work takes them a long way from the ship, and frequently they are lost in storms and fog. Some of the schooners engaged in the industry formerly operated on the Atlantic grounds, but some years since came to the Pacific Northwest, via Cape Horn, as a more fertile field. Halibut usually brings the fishermen from 4 cents to 5 cents per pound, and a 400-pounder is thus worth from $16 to $20. Pulling up twenty-dollar gold pieces from the depths of the sea must indeed be exciting sport, but few of us will envy the brave men the reward they reap. If we did, competition might be keener.

Cleaning the day's catch

Frozen halibut stored at Seattle

Halibut cannot be artificially propagated, as salmon can, because halibut deposit their eggs on the ocean bottom. Hence man has not yet found a way to rob them and incubate the eggs. For this reason, if harvested too freely, the supply may some day run out for a time. On this account, steps are to be taken to protect the fish by a closed season. Legislation will probably provide an ocean sanctuary, covering what has been determined to be the breeding grounds, in the Pacific Northwest.

The Current Supplement

THE current issue of the SCIENTIFIC AMERICAN SUPPLEMET, No. 2110, for June 10th, contains the fourth of the valuable articles on *Economy in Study*. These articles are of extreme importance not only to the teacher, but to everybody who reads, as the world of knowledge is now so vast that without systematic and scientific methods of acquiring information our field is discouragingly narrow. A short, illustrated article on *Locating Bullets in the Human Body* tells how the Roentgen ray is used for making the operation for their removal both simple and rapid, to the great advantage of the patient. Another war article on *The Mountain Gun and Mule Team* tells how light guns of special construction are transported in mountain country. The series of lectures by Sir J. J. Thomson on *Radiations from Atoms and Electrons* is concluded in this issue. *Good Roads and the Automobile* is a timely subject, and is illustrated by a number of excellent photographs. *The Noble Gases* tells how the nitrogen of a generation ago has been made to yield other elements of value to chemistry. These include Helium, Neon, Argon, Krypton and Xenon, some of which are as yet hardly known even by name to the general public. *Progress in Arc Lamp Technology* describes and illustrates a number of improved lamps that have been introduced abroad. *Mechanotherapy at Home* illustrates a simple exercising apparatus that is useful for preventing stiff joints resulting from wounds. It is also useful for general exercise. *Chemistry of the Amorphous Solids* is an attempt to generalize some of the mass of information that has accumulated in this branch of chemistry in recent years. *Invar and Related Nickel Steels* describes an alloy whose peculiar properties makes it of special value in the construction of scientific instruments. Another article of present interest is *Oils and Other Reagents in Flotation*, which deals with recent methods of concentrating ores.

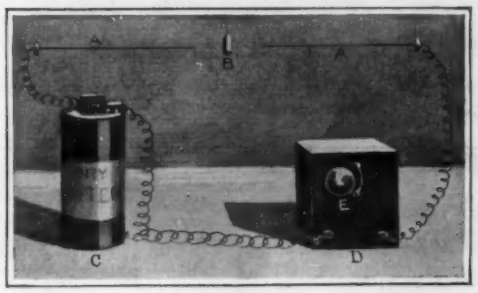
Experiments with Brines in Search for Potash

SEVERAL deep holes have been sunk in the deserts of Nevada, and one is being drilled in the panhandle of Texas under the supervision of the United States Geological Survey, in the search for potash. The Survey is also making some laboratory experiments designed to aid in discovering a cheap process of separating potassium salts from natural brines.

Since the importations of potash salts from Germany were stopped, the urgent need of a domestic supply has greatly increased, and the price of high-grade potash has advanced from $39 to about $500 a ton. Efforts to find commercially workable deposits in this country have been eagerly and diligently made, both by private capitalists and public agencies. The Survey has endeavored both to find deposits of soluble potash salts and to discover practicable methods of extracting potash from rocks that carry relatively large proportions of potassium. Every clue that might yield valuable results has been followed up in a country-wide investigation extending from New York to California.

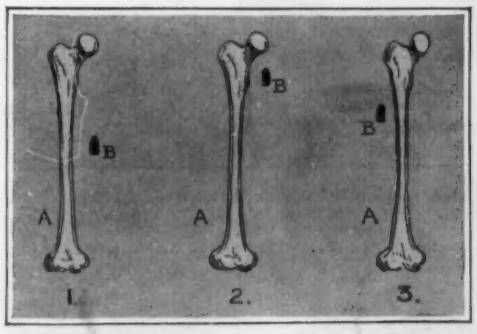
In the laboratory experiments special attention has been given to the evaporation of brines rich in potassium. The results of some of the earlier work were published late in 1915 as Professional Paper 95-E. More recent experiments have been made with the natural brine from Searles Lake, Cal., which contains the equivalent of nearly 12 per cent of potassium chloride in the solid salts. The results are given in a recent survey publication, "Evaporation of Brine from Searles Lake, Cal.," issued as Professional Paper 98-A. This report shows the changes in the composition of the crystals deposited from the hot solution during evaporation, and the composition of the crystals deposited when the solution was cooled. The data recorded indicate that carefully controlled fractional evaporation and crystallization, possibly combined with other treatment, promise much as a means of obtaining potassium from brines similar to that of Searles Lake. Further study of the behavior of the constituents of the brine under varying conditions may be made.

Apparatus for probing with a single needle



The electrical probe

(a) Fine steel needles. (b) Bullet. (d) Electric annunciator.



Three shadowgraphs of the same bullet, from different angles, illustrating how deceptive the X-ray may be

A By-Product of the Sewer

CONSIDERABLE attention has recently been directed to a machine for drying sludge, invented and patented by a firm in the Leeds district of England. It is claimed by the firm that this machine has made it possible to dry sewage sludge profitably, and that it is especially suitable for drying filter-pressed sludge cake containing moisture in any proportion up to 75 per cent. In reply to inquiries, the firm reports that the cost of converting 60 per cent sludge cake through the machine, including interest and repayment of capital, has been $1.94 per dry ton, while the fertilizer is worth $7.30 per ton and upward, according to the amount of ammonia it contains.

Electric Probes

Supplementing the X-Ray in Hunting for Bullets in the Human Body

By Robert G. Skerrett

MUCH as the X-ray has done to help the surgeon locate bullets or bits of shrapnel, etc., in the bodies of wounded soldiers, this penetrating eye of science is not infallible. The radiograph is, in fact, strictly speaking, a shadowgraph, and even when photographs of this sort are taken from two angles there is still a chance of misunderstanding. Shadowgraph geometry or surveying in a fog, as it might well be called, is not necessarily accurate, for the doctor must still do a deal of guessing.

An X-ray apparatus is not unlike a candle in some particulars. It projects shadows according to the relative opacity of the substances through which it sends its beams, and the position of these shadows, in relation to one another, depends upon the angle at which the light is placed. For instance, hold a ball by a thread in front of a blank wall upon which a vertical line has been drawn. Assume the ball to represent a bullet embedded in the flesh of a patient's leg and the line on the wall to stand for the single big bone of the upper leg. Depending upon where the candle is held, the shadow of the ball will shift in its relation up and down or to the right or left of the imaginary bone. So much for one of the difficulties of localization reduced to simple terms.

Again, since the bullet or piece of shell is extremely opaque compared with the texture of a bone, the shadowgraph of the bone will always be lighter than that of the missile, and, for that reason, a single radiograph will not tell whether the projectile is in front of the bone or behind it. Two radiographs taken at right angles will help to solve this matter of location in a general way, but, again, they will not indicate with certainty the distance of the metal object forward or back in relation to the picture plane. Instances have been cited where X-ray pictures had apparently localized the bullet, and yet after three hours of operating the missile could not be found by the surgeon. In military surgery time is too precious to permit anything like this.

The British military medical authorities have been using for many months two electrical aids to supplement the radiographs. One consists of two thin steel needles forming the terminals of an electric circuit. The circuit is closed when both needle points are brought against the embedded metal, and this serves to ring a little bell. The other, an adaptation of the telephone, is more ingenious and reduces by 50 per cent. the amount of probing required.

One end of the telephone circuit is secured to a small piece of platinum, and this disk, after the flesh has been moistened with salt water, is secured to the patient's skin by means of adhesive plaster. The other part of the circuit is in the form of a disinfected silver thread which is attached to the surgeon's instrument then in use—be that a knife, a probe, a needle, or forceps. The moment the operator's instrument enters the flesh this contact produces a slight sound, but this is faint compared with the microphonic rattle that is heard the instant the scalpel or probe touches the metal embedded in the wounded man's body. It has been said that this telephonic aid to the surgeon has been of the greatest value, making it possible to limit to the smallest dimensions the operative wound and reducing to a minimum the time needed for the extraction of small foreign bodies.

Adhesion Tests for Fabrics in Rubber Industry

THE United States Bureau of Standards has installed in its rubber-testing laboratory a newly designed autographic machine for testing the "friction" or adhesion between the different plies of canvas used in rubber hose, rubber belting, automobile tires, etc. This machine, by means of a diagram that is made automatically during the test, shows the exact value of the adhesion between the adjacent layers of fabric at all points. The machine was designed and built at the Bureau of Standards.

The Bureau is experimenting with several rubber compounds that have been made into eyeshades for use in connection with the range finders on battleships. Some of these shades have been molded in the Bureau's experimental laboratory and will be tested in service to ascertain the compound best suited for such use.

An important recent test was in connection with fire hose purchased for use in the District of Columbia. Samples representing 28,000 feet of fire hose were tested both physically and chemically to determine if the specifications had been complied with.

The Scientific American War Game in Miniature

By H. S. Gladwin

THE SCIENTIFIC AMERICAN war game series which came to a close with the issue of June 3rd, has been put to practical use by Mr. H. S. Gladwin. He has built a model of the terrain of the games on a plot measuring 40 by 50 feet and, with an elaborate equipment of toy infantry, cavalry and artillery, has taught a group of young boys how military maneuvers may be conducted. The accompanying photographs show the wonderful realism of the miniature war games. They possess a fascination even for the grown-up, gray-bearded boy.

Now that our war games have ended, we should be very glad to learn how they have been used by other readers of the SCIENTIFIC AMERICAN.— EDITOR.

AS a boy, while in England, I derived a great deal of pleasure from the lead soldiers of English make which were sold as types of the British army, comprising practically all branches of the service. They were of better workmanship than any which I have seen elsewhere, about 3 inches in height, and, being hollow, they weighed less and cost less than those usually to be found in toy stores.

Two years ago, my son being five years old, I was fortunate in finding that one of the large department stores in New York had accepted the agency for these soldiers in America. I at once began to lay in a generous supply against the time when my boy should become interested.

The Infantry consists of Grenadiers, Highlanders, Territorials and the Worcestershire Regiment: the Cavalry included Hussars, Lancers, Dragoons, Scots Greys, Life and Horse Guards: Artillery was made up of Royal Horse Artillery, Royal Field Artillery and Mule Batteries. Besides these I secured some Camel Corps, Medical Corps, Engineers, etc.

About March 1st of this year it occurred to me to ask five other boys, aged from eight to ten, to my house on Saturday afternoons, to give them the use of the soldiers and by instruction and supervision to instill in their young minds the value and organization of the different units that go to the making of an army, so that, in playing with their soldiers, it would be not so much a competition of destruction as of instruction.

They were each provided with a regiment of Infantry consisting of 96 men, with a Colonel and Lieut.-Colonel, mounted, in command. Their first day was spent in dividing this regiment into three Battalions of 32 men each, a Major, mounted, in command of each Battalion. The Battalions were then divided into four companies of eight men each with a Captain in charge, the whole regiment being drawn up, first in column of companies, and then in column of squads.

The next two Saturdays were devoted to the security of a column on the march, and each boy was taught to send out Advance, Flank and Rear Guards.

It was at this time that the War Game was begun in the SCIENTIFIC AMERICAN, and I at once decided to utilize the information of the game to help instruct the boys. We thereupon took the map of the terrain, divided it into 20 squares of equal size, and duplicated these squares on a plot of ground in my garden, 40 x 50 feet.

The Nehaminy River was staked out, excavated to a depth of about 8 inches, 3 inches of gravel were tamped into the bed of the river and then finished off with about 1 inch of sand and cement, mixed in the proportion of 3 to 1.

The dirt from the river and Green Lake was used to make Lookout Mountain and Chester Hill, and the surplus sand and gravel we have since utilized for trenches and embankments. Pine boards, 1 x 6, dressed, were used for roads, rough hemlock boards for the bed of the railroad. We have reproduced the railroad with a 2-inch track and mechanical locomotive and train.

The boys build the steel railroad bridges with Meccano, the stone bridges with Anchor blocks, and the wooden bridges are generally pontoon since they much prefer this type of construction. Incidentally, the planks of the pontoon bridges are 4-inch wooden garden labels, and serve the purpose very well. The pontoons I made myself out of sheet tin, the scow-shaped bow and stern requiring very little solder.

The houses in Pottstown and in the villages are of cardboard and are to be found in all the department stores. They require a small stake, driven into the ground, to hold them in place and prevent their being blown away by the wind.

Our proceedure on Saturdays is for my boy, usually with someone to help him, to spend the morning in setting up the houses, tracks and incidental scenery, so that, when the rest of us arrive at 2:30 everything is in readiness except the soldiers.

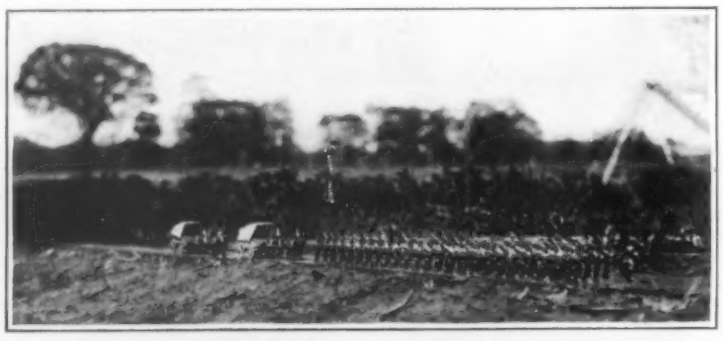
I have reduced the time of the war game from days to hours, but no other change has been made.

The map is laid out on a table, the boys divided into two sides, three on the Red, three on the Blue; and the Blue side remains by the table to receive orders and instructions. During this time the Red side retires out of hearing. While these orders are being executed the Red side receives its instructions and so on until the situation is completely developed.

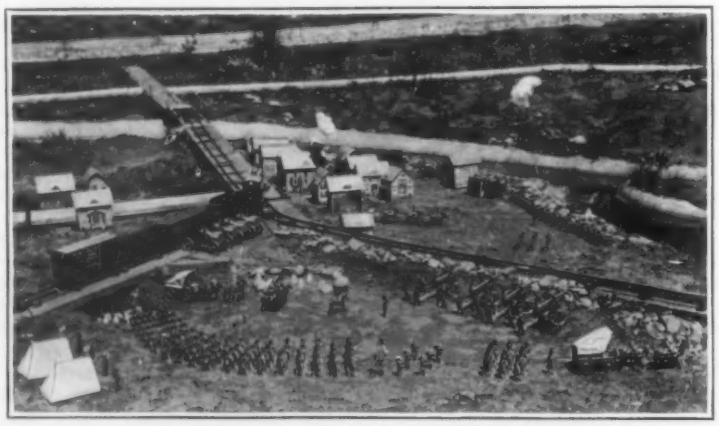
When this point has been reached we hold a Council of War. I attempt to explain the why and wherefore of the various movements of troops, pointing out particularly the necessity for supports and reserves, and emphasizing the importance of outpost and intelligence service. I do not attempt to read the actual text of the War Game articles as they are not old enough to understand; but we talk over the situation in language which is intelligible to them. We then dismiss the war game and get down to the fighting stage of the combat.

Each boy is equipped with a machine gun capable of firing 36 wooden shells attached to a tape. These guns are sufficiently like the real article to exercise an unholy fascination for them. The boys are stationed behind the miniature field guns in the positions that the War Game has dictated for them, and are only permitted to advance when the miniature batteries are advanced. Should an advance be made without sufficient support,

(Concluded on page 627)



Blue column en route, Norrisville to Pottstown, having picked up outposts which were stationed on Clan Road-Bowers Bridge



The First Battalion of Blue Infantry having arrived at Lookout Mountain by train, the balance of the regiment advances from Pottstown

The main Blue detachment arrives in Pottstown

Looking southwest from Chester Hill

A group of water-ski enthusiasts. A double paddle is used as an aid in maneuvering the pontoons

New type of water-skis developed by Italian engineer, showing the paddle wheel used for propulsion purposes

Water Shoes for Sporting and Military Purposes

WALKING on water by means of water shoes or skis is not a new sport, but its periodic reappearance in one form or another is always attended with interest. This time the sport is suggested by an Italian engineer, who has evolved an ingenious form of shoe to which he gives the name "hydro ski."

The new water shoes or skis consist of two pontoons, one for each foot of the wearer, just as with the ordinary water shoes. But the method of propulsion is decidedly unique and immeasurably more efficient than that of the majority of forms introduced in the past. It has been the general practice to use ordinary pontoons, which are manipulated in much the same manner as skis or snow shoes; that is to say, first one foot and then the other is slightly raised and moved forward, resulting in a forward motion of the wearer. However, it is not so easy to secure a hold on the surface of a body of water as it is to secure a hold on snow, and hence this method when applied to water walking has been attended by laborious and slow progress unless the walker was unusually robust and skillful.

In order to overcome the difficulties of water walking heretofore experienced, the present shoes are provided with two sets of cross arms to which paddles are fitted at their extremities. It will be noted in the illustration that one arm is held to one pontoon by means of a small shaft, while the other arm is held to the other pontoon in the same manner. The shafts are not in alignment, so by an upward and forward manipulation of each pontoon in turn the paddle wheel not only serves to give the necessary hold on the water but also rotates with sufficient power to propel the pontoons and their load forward at a fair rate of speed without undue exertion on the part of the water walker. Steering and difficult maneuvering is facilitated by the use of a double-blade paddle.

The Italian inventor, not content with introducing his improved shoes in the field of outdoor sports, has made a number of experiments with a view to their adaptability in military operations. At the present time the outcome of these experiments is not known.

Ernolith: A New Celluloid Substitute

IT is only of recent years, and largely owing to the researches of the Berlin Institute of Fermentive Industries, that the very remarkable properties of yeast, aside from its levitating power, have been realized. Not only can valuable extracts be obtained from it, useful as flavoring matter and for tonic and medicinal qualities, but it contains a relatively large percentage of protein, or albuminous matter. Finally the mass of cellulose which constitutes its remaining constituent, and which is composed of uncommonly tiny and delicate cells, is capable of various reactions with other substances. This latter property has been taken advantage of for the formation of plastic masses by combination with aldehydes. When these masses are subjected to heat under pressure a hard solid is obtained, known as ernolith, which makes an excellent substitute for celluloid, ebonite, galalith, bakelite, resinite, etc.

Two research chemists, H. Blücher and E. Krause, whose work is reported in the *Chemiker Zeitung*, have been able to vary the degree of hardness and elasticity of this product within certain limits. The color, which is originally black, can also be varied by the incorporation of mineral or vegetable dyes, so that shades of yellow, gray, brown, red, green and blue can be obtained, as well as marbled or veined effects. To the fundamental components of ernolith, yeast and aldehyde (particularly formaldehyde) other constituents may be added which cause a modification of the chemical and mechanical properties.

The process of manufacture consists of two phases: first, the union of the yeast and the aldehyde (with various "fillers" and subsidiary reactions). The mass thus obtained is dried and ground, and in this form is indefinitely durable. This powder is known as a "half-fabricate," or "raw ernolith." The next step is its compression in heated hydraulic presses. The articles thus obtained are said to reproduce on their surface the most delicate details of form, such, for instance, as those of relief maps, etc.

Aside from this capacity for being directly molded, ernolith is capable of being sawed, filed, bored, turned, engraved, ground, polished and otherwise mechanically acted upon. It has an exceedingly close, dense structure and a conchoidal fracture. As remarked, the process of manufacture may be so varied as to make the product very hard and brittle, or softer and more elastic, as may be required. It possesses a very decided advantage over celluloid in being almost entirely uninflammable, being very difficult to char. Another excellence is the economy of production since the raw powder may be precisely measured, thus avoiding scraps and trimmings. Its specific gravity, when pure (*i. e.*, without fillers) is 1.33-1.35.

Among the many objects for which it may be used are door handles, window attachments, handles for knives, tools, etc., bas-reliefs and other sculptures, card-plates, lamp-bases, picture frames, mural decorations, etc., as well as innumerable articles in fine mechanics and technology.

Ernolith also has the quality of adhering very tightly to metal threads and tissues pressed into it. This makes it highly adaptable for making articles when a metal surface or core, as in buttons, or door-handles, is to be united with a composition. As primary material, it is possible to employ not only the ordinary waste yeast of breweries, but also the "air-made" yeast of the Delbrück process.

Purifying Swimming Pools

COPPER sulphate in small amounts is more suitable for purifying public swimming pools than is calcium hypochlorite or bleaching powder. The latter loses its efficiency with use and is irritating to eyes and mucous membranes. None of these objections holds with the blue vitriol.

Improvised Submarine Made from Odds and Ends

THE one-man submarine shown in the accompanying illustrations embodies no new principles of construction but undoubtedly represents a most economic application of old ones. The wash-boiler, when inverted and filled with air, has just sufficient buoyancy in water to sustain a 100-pound sack of hardened cement. The crew sits on the rock until enough air escapes to allow of sinking. The imprisoned air that remains can be breathed several times and will allow a good swimmer to remain under water for a period anywhere from 10 to 15 minutes. A line fastened to a lard-can float acts as a signal to an assistant on the surface who increases the buoyancy of the diving bell by forcing more air down to it through a garden hose with a bicycle pump and brings the submarine and its crew to the surface.

The U-23 was hastily assembled to meet an emergency in time of peace, and the inventor looks with extreme disfavor on proposals that it be equipped with torpedo tubes or used for war purposes in any way.

Making final adjustments on the home-made submarine before a journey

The improvised submarine boat in dry dock after a successful cruise with her one-man crew

The mechanism of the home-made submarine and how it is arranged

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Using a Phonograph in an Automobile

THE utility of the motor vehicle is being demonstrated in new and interesting ways every day. The latest illustration of this brought to our attention is to be found in a letter recently written by Mr. Arthur Brisbane, the New York editor, to the manufacturer of his car, in which he says:

"I write this on my way to Hempstead from my office in New York. I have installed in my car a phonograph, resting on a cushioned box which I have devised. The car is going a little over 30 miles an hour, as I glance at the speedometer, on the average Long Island road. And I am able to utilize the time on the way home working, writing—a great saving, and one that I believe will be of vast importance to business men. When you talk to business men about the use of an automobile, point out to them the fact that taking a car to and from the city is no longer a luxury, but common-sense economy of time. The car adds two (working) hours to my day, and two working hours in the fresh air. The sum total of hundreds of millions of hours that working Americans spend in their automobiles can now be made useful—the best hours of the day. To work in a car with the window open, fresh air pouring in, no interruptions from the telephone, is indeed a luxury, and a productive luxury, which is the only good luxury."

Since the letter was written, the recipient, at Mr. Brisbane's invitation, drove out to the Edison laboratory in the editor's car for the purpose of showing the device to the famous inventor. To say that he was delighted with Mr. Brisbane's ingenuity in utilizing the phonograph in such an original manner would be putting it mildly. He not only watched the process of dictation into the machine, but, as shown in our illustration, tried the experiment himself.

Thomas A. Edison dictating letters in an automobile

A Device Which Makes Broiling or Roasting Simple

THE problem of successfully reversing a piece of meat held in a gridiron or analogous device, so that a new side may be presented to the direct heat of the flame of a gas stove, has been solved in a recent invention. Not alone that, but the distance between meat and flame can be instantly varied by the simple manipulation of a lever. Credit for the invention, which thus simplifies broiling or roasting to a material degree, belongs to Henrietta W. Lawrence of Baltimore, and Harry J. Lebherz of Frederick, Md.

The reversible broiler, as it is called, consists primarily of a simple cast frame in the form of a double crutch, the two ends of which are joined and held together by suitable cross members. The frame terminates at the top in small shoulders, which are provided with notched levers or pawls. The meat to be broiled or roasted is placed in a broiler rack or gridiron that is hinged on one side and provided with suitable clasps at the other. It opens in much the same manner as a book to admit the meat between the two covers, after which the notched clasps are used to firmly close the members. The clasps are provided with a plurality of notches in order firmly to grip meat of varying thickness between the members. The gridiron is also provided with a handle in the center of one end, by means of which it can be manipulated.

Returning to the frame, it will be noted in the accompanying illustration of the device that on either side is a hinged, shelf-like projection. These members are, in reality, bearing members serving to engage with the shelf- or pan-holders or ledges found in the oven of practically every standard gas stove. By the manipulation of a lever (not shown in the illustration), the wing-like members may be withdrawn from the ledges in order to raise or lower the entire frame with its gridiron without removing it from the oven. Thus it is possible to vary the distance at will between the flame and the article that is being cooked.

To reverse the meat in the gridiron, the handle of this member is taken with one hand, while the other

The reversible broiler and how it is used in the oven of a conventional gas stove

hand moves a long lever at the left of the frame, which causes the left-hand pawls or notched, holding members at the top to release one side of the gridiron. The free end of the latter then swoops down, traveling on the crotch frame which acts as a track, and when it has reached the bottom the handle is given a sharp twist, disengaging the right-hand side of the gridiron from the pawls and swinging it over to the left-hand pawls. The handle is then turned still further, bringing the present free end of the gridiron into engagement with the right-hand pawls, thus completing the reversing operation. Naturally, all this occurs in a fraction of a minute's time, and is quite simple.

The frame is glazed inside so that the drippings from the meat can be collected on a plate placed below it. A slot is cut through the bottom of the frame for the purpose, and in a recent form the frame is provided with hooks for holding a plate.

A Telephone Directory that Operates Like a Window Shade

BY employing the principle of the conventional window-shade, an American inventor has developed a telephone directory of novel design. It is so constructed that a flexible strip upon which the information is tabulated is retained within a cylinder, protected from dust and injury, and is available at a moment's notice by the slight pull of the hand. The strip is returned automatically to the cylinder as soon as released, after the reference is completed. The containing cylinder, as will be noted in the accompanying illustration, is fastened to the usual desk telephone instrument by means of a suitable clamp.

The strip of the new telephone directory is made so that printing, typewriting, hand-writing, or any other form of information, may be clearly shown upon it. The material used in the curtain is a form of tough, glazed cloth, which winds on a spool within the cylinder. A slot at the top of the spool engages with a pin carried by the shaft of a small spring which has sufficient strength to return the curtain onto the spool and normally keep it there. By turning the cap at the top of the cylinder, which contains the spring member, more or less tension can be applied on the curtain. The free end of the curtain terminates in a handy, hollow metal rod for holding purposes.

When additions or changes are to be made to the telephone directory, the curtain can be readily removed from its spool and end piece. By an upward pull on the top cap of the cylinder the spring member, spool and curtain are removed, the two latter being suspended from the spring cap. The curtain is then freed from its spool by pulling off one of the ends of the latter, which exposes the end of a slot that serves to hold the curtain, and sliding out the last-mentioned member. In much the same way the other end of the curtain is removed from the metal rod by pulling out a tapered metal plug and sliding out the curtain through the end of the retaining slot. The curtain is finished off at both ends with welts, which serve to hold it securely in the slots.

By a slight pull of the hand, this novel telephone directory is brought to view, only to return into its container when released

Wanted—A Trade Mark

AN offer of a thousand dollars in gold for the best original design of a trade mark has been made by the Western Union Life Company of Spokane, Washington. The contest closes on October 15th, 1916. Particulars may be had of the company at the above address.

Legal Notes

Electrical Transmission of Images.—Eliot Keen, of New York City, in three recent patents, some of which are assigned to the Telegravure Company, a corporation of New York, discloses some interesting improvements in electrically transmitting pictures and photographs to distant points and successfully reproducing the images at the receiving end. By his improvement the inventor reduces the picture to a half tone plate of novel characteristics for the sending end, and secures a transformation of the telegraphed record into a substantial dupli-

(Concluded on page 626.)

Across the Continent from Monday to Monday

Cadillac in thrilling dash from Pacific to Atlantic shows incomparable stability and sustained speed

Los Angeles to New York in 7 days, 11 hours. 52 minutes

THE quickest way to appreciate the wonder of this triumphant trans-continental Cadillac trip is to close your eyes and call up two pictures—one of the start, and the other of the finish.

Transport yourself first, to beautiful Los Angeles, and imagine a Cadillac leaving the city one minute after midnight on a Monday morning, the second week in May.

Then, blot out the picture of Los Angeles and substitute New York, and try to conceive *the same car with the same driver swinging blithely up Broadway the Monday following.*

No effort of your imagination, no words of ours, and nothing less graphic than a motion picture record can portray the heroic character of the work done by this Cadillac in the interim —between these two Mondays in May.

But the start and the finish, the distance covered, the remarkable time made, the great reduction made from the previous record—all these spell the superlative character of the performance so plainly that no motorist can fail to grasp its meaning.

The Cadillac which 'conquered the continent' was just such a Cadillac as you might buy and drive yourself.

It was equipped as your Cadillac would be equipped, with no special preparations other than those which would ordinarily be made for a long distance tour.

The trans-continental Cadillac was not a specially built car 'stripped for action'—but a fully equipped standard Roadster; and, granting that you possessed the stamina of its single driver, the journey was one which you yourself might take if you were so inclined.

But, because of the terrific speed almost continually sustained, it involved, of course, hardships to man and car of an unprecedented character.

What it proves of Cadillac stability and endurance is aptly illustrated by a comparison between the Cadillac cross-continent record and the railroad schedule between the two cities.

The distance by rail is 3240 miles—the distance covered by the one Cadillac was 3371 miles.

In the regular railroad schedule between Los Angeles and New York, in spite of smooth tracks, solid road-bed and clear right-of-way, a relay of twenty-two locomotives is called into action.

Consider, now, the almost miraculous endurance of the car, handicapped a hundred times over in the matter of road-bed, yet it traveled its distance without so much attention to its motor as the cleaning of a spark plug.

Its rate of travel ranged from only 5 miles per hour, plowing through hub-deep mud, to 68 miles per hour on smooth stretches.

The railroad schedule is 90 hours—and the Cadillac *cut 91 hours and 23 minutes off the previous motor car record* made by the same driver in another make of car.

The Cadillac left Los Angeles at 12:01 A.M. Monday, May 8th, and arrived in New York City at 2:53 P.M. Monday, May 15th, with intervals for food and sleep.

In that eventful period of little more than a week, it was put through a more terrific trial of stamina than the majority of cars encounter in ten years of travel.

Over mountain ranges, along precipitous passes, through desert wastes, fording unbridged streams, and through roads almost impassable at their best but made worse by this spring's copious rains, the Cadillac hurtled heroically on—not merely defying destruction, but unruffled, undisturbed and undaunted.

The wonder of the thing, is not that the trip was made without disaster.

The real wonder of it is not in the limited time that elapsed.

No, the real wonder, and the really valuable lesson, is that this wonderful thing was done with such unprecedented ease.

That this trans-continental Cadillac broke the previous record by nearly four days is incidental to the real achievement.

The real achievement rests in the fact that it emerged from the fray virtually as good a Cadillac as when it began.

It is still a Cadillac with many thousands of miles of service ahead of it.

All that the Cadillac has demonstrated before, is now demonstrated anew in another way.

We all know, now, beyond doubt, that there is not in this nation a set of road conditions which can successfully challenge Cadillac construction.

We all know that the Cadillac has again proven itself to be

The World's Greatest Road Car.

Cadillac
Standard of the World

LEGAL NOTES

(*Concluded from page* 624)

cate of the original picture at the receiving end. He claims to have overcome the heretofore insurmountable difficulty of securing that degree of synchronism between the sending and receiving machines required by prior improvements in this line and to provide an apparatus by which using a half tone cut or its equivalent he produces and transmits a series of electrical impulses proportioned to the size of the several dots composing the half tone in such manner as to reproduce a half tone picture of exactly the appearance of the original half tone.

Limitation of Amendment After Opposition. — In D. H. Burrell & Co. vs. Simplex Electric Heating Co. in a second opposition the Court of Appeals by Mr. Justice Robb said: "After an applicant has been defeated in an opposition proceeding he may be permitted to amend his application, but he must eliminate therefrom every ground of controversy which was involved in the opposition proceeding, for unless he does so that proceeding is rendered abortive and a second controversy started over a question that the prior decision put at rest."

Danger of Delaying Patent Applications —The Court of Appeals in affirming the decision of the Commissioner in re Pope suggests that,

"Though it is true that a patent may not be withheld because of delay authorized by the statute, we agree with the Commissioner that an applicant who has prolonged his application for a period of years, knowing that the device covered thereby has gone into public use, is not in a position to demand more than is strictly due him. In such a situation, the Commissioner would be fully justified in reversing the ordinary rule by resolving doubts against the applicant."

The "American Girl" Trademark Case.—In Hamilton-Brown Shoe Co. vs. The Wolf Brothers & Co., the Supreme Court in a decision delivered by Mr. Justice Pitney in over-ruling the decision of the Circuit Court of Appeals does not regard the words "The American Girl" employed in connection with shoes as being a geographical or descriptive term, but holds that it does not signify that the shoes are manufactured in America or intended to be sold or used in America, nor does it indicate the quality or characteristics of the shoes. "Indeed," the Court said, "It does not, in its primary signification indicate shoes at all." Having held that the complaint is entitled to the use of the words "The American Girl" as a trade-mark the Court held it entitled to the profits acquired by the defendant from infringing sales under the label "American Lady" to the extent that such profits were awarded by the decree below amounting to hundreds of thousands of dollars, probably the largest judgment ever awarded in a trade-mark infringement suit.

Making Railway Rails Continuous by Means of the Electric Arc

(*Concluded from page* 617)

ages 100 bonds per day and is carried about on a car. Its crew comprises four men, a bonder and three helpers. The car, which is 6 feet 10 inches long by 5 feet 10 inches wide, carries an 18-kilowatt rotary converter and transformer, with the necessary apparatus for welding operations. As would naturally be expected, welding outfits are made in a wide variety of designs and sizes, so the apparatus just mentioned can only be considered as one example.

To weld an average sized rail bond to a rail an alternating current of 2,000 amperes at 5 volts is employed. On direct current railroads the required current is obtained by converting and transforming about 20 amperes at 500 volts taken from the third rail or trolley wire. As a general rule, the welding current should not exceed a potential of 25 volts at the arc. In its crudest form an arc welding outfit may make use of a water resistance for reducing the current to the desired po-

LEGAL NOTICES

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WE FURNISH FREE blue prints and instructions; clock works complete with dial, pendulum, gong, etc., $5.00; others with chimes, all prices. Clock Co., Nicetown, Philadelphia.

DRAFTSMEN WANTED

DRAFTSMEN WANTED, experienced on grinding machinery and tool design. Application must contain full particulars relative to experience. The New Departure Mfg. Co., Employment Bureau, Bristol, Conn.

tential; but since this procedure is extremely wasteful of power, a rotary converter is preferred, not only because of its efficiency, but also on account of the better regulation obtainable. The welding tool proper consists of a simple holder carrying an electrode of carbon or metal; the former is used for cutting or heavy current welding, while the latter is employed to build up or fill cavities. In some instances the electrodes combine a flux which prevents the metal parts of the work from oxidizing, but in actual practice this provision is found to be unnecessary.

The amount of current required for any given work varies to a great extent because of the many factors involved. It is seldom that welding operations can be conducted with less than 50 amperes, and currents as high as 150 amperes are not unusual in ordinary instances. However, in the case of thin sheets currents as low as 15 amperes may suffice. On extra heavy work 150 to 200 amperes may be necessary. The foregoing figures are for metal electrodes; graphite arc welding averages 350 to 500 amperes on general work, and 100 amperes on small work to 600 amperes on unusually heavy undertakings. Carbon arcs, which are employed in cutting operations, require anywhere from 300 amperes on small sections up to 1,000 amperes or more, with an average of 400 to 600 amperes.

Expansion and contraction of street car rails are taken care of in the welding of the rails. Generally the rails are not absolutely welded together; a strip or other connecting member being welded to each rail so as to form a homogeneous connection. So intense are the heat and light emitted by the electric arc that the worker must protect himself by wearing a heat-resisting mask provided with a colored glass window, and a heavy pair of gloves, as illustrated in the front cover illustration of this issue.

The Scientific American War Game in Miniature

(*Concluded from page* 622)

in our case 30 Cavalry or 64 Infantry for a battery of four guns, or should this support be appreciably diminished by the enemy's fire, the boy who has caused the advance is subject to capture, together with his miniature battery. Such a denouement at once causes the wildest rejoicing on the one hand and the blackest despair on the other.

We are formulating new rules for this supplement to the war game as we go along, but I have hesitated to complicate them with too many restrictions. I have never seen boys enjoy themselves more and am constantly surprised at the amount of information which they have absorbed. At the same time I have no hesitancy in saying that I enjoy my Saturdays just as much as the boys do and look forward to them with just as much pleasurable anticipation.

NEW BOOKS, ETC.

THE IRISH AT THE FRONT. By Michael MacDonagh. New York: Hodder and Stoughton, 1916. 12mo.; 158 pp. Price, 75 cents.

To this narration of valorous deeds John Redmond has written a delightfully Irish introduction. One should read the book first, or he may deem the introduction too enthusiastic; having read the book, he may no longer deny that all the enthusiasm and all the pride are amply justified. We are told how the Munsters saved the guns in the retreat from Mons, how the Irish Guards rallied to the green flag at the Marne, how the Liverpool Irish dared the asphyxiating gas and liquid fire, how the 7th Dublins gallantly stood and gallantly fell in the fight for Kisiah Dagh, and how the London Irish made their historic football charge at Loos with the German trenches as goal.

TRADEMARK POWER. An Expedition into an Unprobed and Inviting Wilderness. By Glen Buck. Chicago: Munroe & Southworth, 1916. 8vo.; 112 pp.; illustrated.

The value of the trademark in advertising is now generally, if not fully, appreciated. Psychologically, it is vindicated by the tenet that what compels the eye is more stimulating and tenacious that what assails the ear; pictures came before letters, and the juvenility that is so large a part of the normal human makeup quickly responds to a striking picture or design. The elements of appeal in the trade-

mark cannot be reduced to exact principles that may decide all cases, but in one respect Mr. Buck's sprightly contribution furnishes a welcome first-aid; this is in showing manufacturers and designers what to avoid; with this are offered ideas well worth considering and considerations decidedly worth weighing. The reader cannot long follow these without recognizing the fact that human nature and the trademark are very closely related elements of the advertising art, or without gaining the impression that only a clean-cut, distinctive symbol can carry a product on to success.

THE LOCOMOTIVE. Vol. XXX. Hartford, Conn.: The Hartford Steam Boiler and Insurance Co. 8vo.; 159 pp.; illustrated.

This bound volume "The Locomotive" contains the issues of that bright little quarterly from April, 1914, to October, 1915. It pictures, describes, and comments upon such boiler explosions as are of interest from their unusual violence, or from the lessons they may convey; points in boiler practice form the subject of brief articles; such allied devices as steam gages, and such operations as autogenous welding, are discussed, with frequent remarks on inspection ethods and various other topics of interest to the manufacturers and user of boilers. The element of safety is of course the keynote of the publication.

PRACTICAL ELECTRICIAN COURSE. 3 Volumes. Prepared by Extension Division of School of Engineering of Milwaukee. By Oscar Werwath, E.E., Geo. J. Kirchgasser, E.E., Frederick C. Raeth, and W. E. Hennig. Milwaukee: Electro-force Publishing Co. 8vo. Book I, First Principles of Electricity. 100 pp.; 117 illustrations. Price, $1.25 net. Book II, Theory of Direct Current. 78 pp.; 95 illustrations. Price, $1 net. Book III, Electric Light Wiring. 120 pp.; 184 illustrations. Price, $1 net.

In the "First Principles of Electricity" are concisely stated the fundamentals of electrical knowledge, particularly in connection with such common devices as bells, burglar and fire alarms, self-winding master clocks, and the telegraph. In the "Theory of Direct Current" appears an explanation of series circuits, multiple circuits, electrical power, resistance, and electro-heating. "Electric Light Wiring" discusses direct and alternating currents, insulation and capacity of conductors, interior wiring systems, and fittings and accessories; laboratory experiments are given, and there are chapters on sign lighting and electric illumination. These three volumes, together with two others—"Magnetism and the Commercial Application of Magnets," and "Telephony," constitute Section I of the Course, which is the outgrowth of a decade of actual experience in teaching, and is excellently adapted not only for school use, but also for self-instruction. Simple diction and a regard for the commercial application of all principles characterize the work, which in succeeding sections will deal with the further uses of electricity in their relations to manufactures and industry. The aim is to furnish a comprehensive and thorough library, and if the same high standard as is evident in these first three books is maintained, that aim is already an accomplished fact.

AN ELEMENTARY MANUAL OF RADIO-TELEPHONY. For Students and Operators. By J. A. Fleming, M.A., D.Sc., F.R.S. Longmans, Green and Co., 1916. 8vo.; 360 pp.; illustrated. Price, $2 net.

The author assumes on the part of the reader an elementary knowledge of electrical science, although the present text is addressed to a wider public than his former volume on the Principles of Electric Wave Telegraphy and Telephony. Its material is well suited to the student, the operator, and the general reader who is interested in the subjects of which it treats. Historical matter is subordinated to more directly useful instruction which shall fit the student for more advanced investigation. This is a third edition of the work, with corrections and additions that bring it up to date.

THE MENTAL LIFE OF MONKEYS AND APES. A Study of Ideational Behavior. By Robert M. Yerkes, Harvard University. New York: Henry Holt & Company, 1916. 8vo.; 145 pp.; six plates and five text figures. Price, $1.50.

Our literature of the behavior, psychology, and sociology of the infrahuman primates is deplorably incomplete and inadequate. In this monograph is recorded a number of experiments whose results must contribute largely to a better conception on our part of the mental life and possibilities of monkeys and apes. It is the author's conviction that this study and the knowledge it supplies would directly aid in the solution of many problems of experimental medicine, of physiology, genetics, psychology, sociology, and economics, and should lead to decided improvements in our educational methods. The "Behaviour Monographs" constitute a series of peculiar interest from many points of view, and this one, with its multiple-choice experiments and its supplementary tests of ideational behavior in animals so closely related to man, furnishes material of intense appeal to the naturalist and the coherent thinker.

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¶ A complete practical treatise on the hot and cold machine forming of steel and iron into finished shapes, together with the tools, dies and machinery involved in the manufacture of duplicate forgings and interchangeable hot and cold pressed parts from bar and sheet metal.

American Tool Making and Interchangeable Manufacturing

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¶ A complete treatise on the design, construction, use and installation of tools, jigs, fixtures, devices, special appliances, sheet metal working processes, automatic mechanisms and labor-saving contrivances, together with their use in the lathe, milling machine, turret lathe, screw machine, boring mill, power press, drill, sub-press, drop hammer, etc., for the working of metals and the production of interchangeable machine parts.

Machine Shop Tools and Shop Practice

By WILLIAM H. VAN DERVOORT, M. E. 6½ x 9¼. Cloth. 552 pages, 672 illustrations. Price, $3.00.

¶ This work describes in detail the construction, operation and manipulation of both hand and machine tools. Includes chapters on filing, fitting and scraping surfaces; drills, reamers, taps and dies; lathe and lathe tools; planers and shapers and their tools; milling machines and cutters; gear cutters and gear cutting; drilling machines and drill work; grinding machines and their work; hardening and tempering; gearing, belting and transmission machinery; useful tables and data.

Hardening, Tempering, Annealing and Forging of Steel

By JOSEPH V. WOODWORTH. 6¼ x 9¼. Cloth. 288 pages, 201 illustrations. Price, $2.50.

¶ Treats clearly and concisely all modern processes for the heating, annealing, forging, welding, hardening, tempering and case-hardening of steel, making it a work of great value to tool makers and metal-working mechanics in general. Special directions are given for the successful hardening and tempering of steel tools of every description, also methods for the treatment of special brands of steel.

Steel

Its Selection, Annealing, Hardening and Tempering

By E. R. MARKHAM. 5¼ x 7½. Cloth. 396 pages, 168 illustrations. Price, $2.50.

¶ Gives comprehensive and specific instructions on the methods of hardening a large number of tools. All kinds of annealing and muffle furnaces, blast ovens, open flames, and the use of the lead and cyanide baths are fully described. Case-hardening and pack hardening are treated in a comprehensive manner. A standard work by an acknowledged authority.

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By OSCAR E. PERRIGO, M. E. 6½ x 9½. Cloth. 424 pages, 314 illustrations. Price, $2.50.

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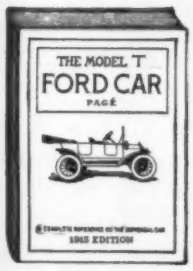

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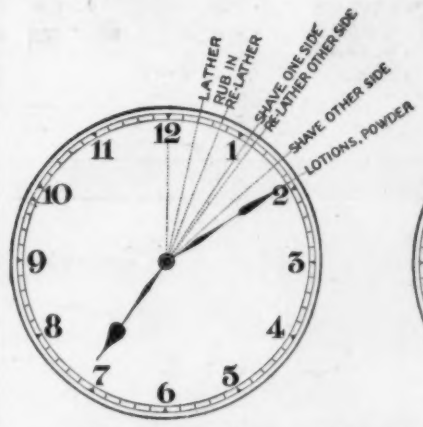

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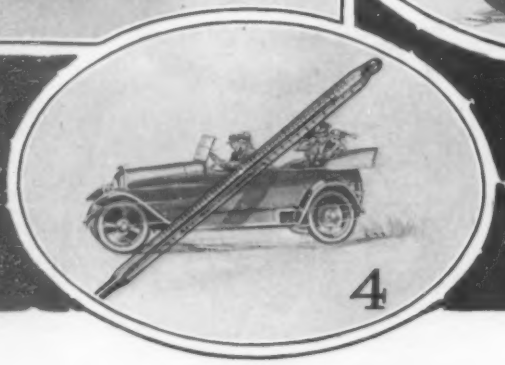
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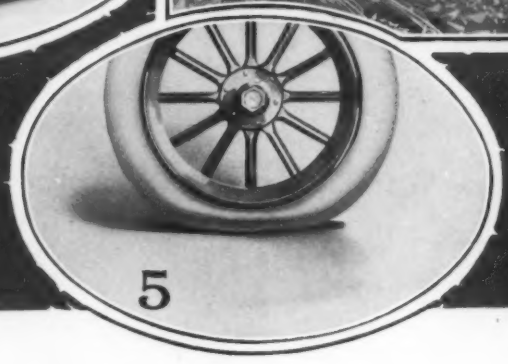
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